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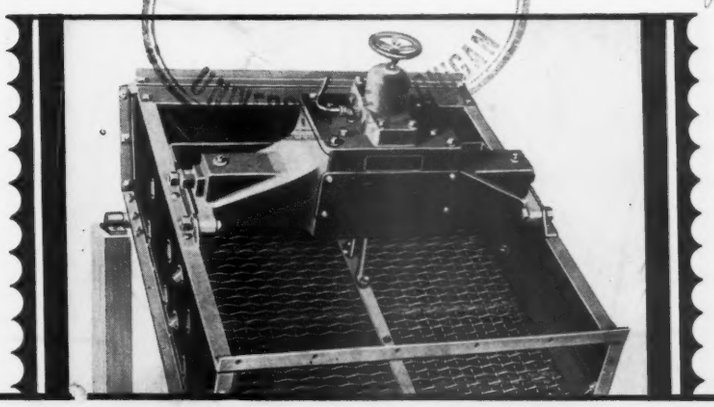

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Pit and Quarry

Vol. 17 OCTOBER 10, 1928 No. 1

MORE RESEARCH FUNDS NEEDED FOR AGRICULTURE

AN INCREASE of at least $2,000,000 is needed during the fiscal year 1929-30 by the U. S. Department of Agriculture for fundamental research work of far-reaching importance to farmers, consumers and the country as a whole, General Herbert M. Lord, director of the budget, was told recently by representatives of 15 national farm and industrial organizations.

This group, which informally affiliated for this purpose about a year ago, includes organizations of farmers, bankers and industries that make goods of many kinds, particularly automobiles, canned foods, fertilizers, leather, lumber and sugar. It should have included the National Agstone Association, National Lime Association, and the Gypsum Industries.

General Lord opened the conference and recalled his pleasant relationship with the group when it made a similar presentation last year. He stated that the Department of Agriculture, in line with the group's request, had been given a total increase of $6,553,000 in its budget for 1928-29 over that of 1927-28. Of this, research received an increase of $1,118,000 directly and $480,000 indirectly under the Purnell act for research at state experiment stations.

General Lord pointed out that the Bureau of the Budget, in preparing the budget for 1929-30, had cut a total of $253,000,000 from the original estimates submitted by all Governmental agencies. Speaking specifically of the Bureau's action with respect to funds for research in the Department of Agriculture, he said that to date no increase had been allowed over that granted last year. However, he pointed out, he had been impressed by the presentation of the group when the budget was being prepared a year ago, and he would treat with deference the further recommendations of the 15 organizations.

Fred Brenckman, Washington representative of the National Grange and spokesman for the organizations, declared that the group is grateful for the progress made last year, but that the total increase granted last year was considerably below what the group considered necessary to meet pressing agricultural problems.

Chester Gray, Washington representative of the American Farm Bureau Federation, mentioned several subjects needing more intensive research, among which were tuberculosis in poultry, various insect pests, cooperative marketing, contagious abortion of livestock, application of power to agriculture, the adaptability of home-grown seed to various sections of the country, and chemical problems that concern the Bureau of Chemistry and soils. He stressed the need of hastening the application of chemistry to agriculture. He emphasized that the group is supporting the request of the Department of Agriculture and is leaving details to the judgment of officials of the department.

Several representatives were called upon by the spokesman to elaborate on the presentation. Miss Mary Bromberg, representing the American Cane Sugar League, told how research is materially helping Louisiana sugar cane growers revive their production, which, prior to the aid of research, had seriously slumped, affecting the prosperity of a large group in the state.

A. M. Loomis, secretary, American Dairy Federation, emphasized the need of further research in behalf of dairymen, especially for cow testing and cooperative bull associations, breeding studies, nutrition studies and a larger equipment for the experiment station at Beltsville, Maryland.

Pyke Johnson, Washington representative, National Automobile Chamber of Commerce, said car manufacturers are interested in research as a means of increasing farm purchasing power and of studying the use of trucks and pleasure cars on farms.

Harry C. Butcher, representing The National Fertilizer Association, reported resolutions adopted by the Second National Fertilizer Conference, held in September at West Baden, Ind., and attended by manufacturers, editors, agronomists and control officials, calling for larger appropriations for both federal and state research in fertilizer. He said that problems of how and where to apply fertilizer with respect to seed, the extent to which fertilizers improve quality of crops, and the need of improving fertilizer distributing machinery were stressed

by the conference as being in especial need of further study. Butcher also emphasized that research is needed to determine the new role of various plant foods on the nutritional effect of feeds for livestock and even food for humans.

Dr. E. A. Loomis, representing the National Canners' Association, expressed the interest of canners in many problems wherein research is of fundamental importance. Edward A. Brand, representing the Tanners Council of America, supported the general program for more research, and stressed particularly the interest of the tanners and cattlemen in getting rid of the cattle grub.

This research work is vital to American Agriculture and deserves the support of all the non-metallic mineral industries. Particularly should the National Agstone Association, the National Lime Association and the Gypsum Industries be active in their support of this research program. Why is it that so many opportunities for co-operative effort are overlooked by associations in the non-metallic mineral industries?

CONFUSION FROM TRAFFIC SIGNALS CAUSES MANY DEATHS

CONFUSION among motorists and pedestrians, growing out of lack of uniformity in traffic regulations, caused the death of more than 2,000 persons during the year 1927, according to a report made public recently by the City Officials' Division of the American Road Builders' Association. Traffic violations caused, during the same period, a total of 2,353 fatalities and most of these, it is declared, were due to the widely divergent traffic laws in effect in the cities and states. In connection with its findings, the City Officials' Division, which is composed of the highway and traffic officials of the principal cities of the country, inaugurated a vigorous campaign for the adoption in all cities and states of the uniform traffic codes recently completed by the National Conference on Street and Highway Safety, sponsored by the Department of Commerce, the American Road Builders' Association, the Chamber of Commerce of the United States and numerous other organizations vitally interested in street construction and traffic regulation.

The control of modern traffic in American cities constitutes an extremely complex problem, the officials of the road builders' organization point out. "The existence of widely divergent methods of signalling, turning and general traffic movement," it is asserted, "proves extremely confusing to motorists accustomed to different systems." This confusion creates a hazard having a most pronounced relation to highway accidents. Investigators find that the effectiveness of uniform ordinances governing the regulation of traffic has already been demonstrated. In one section of the country where uniform laws have been in effect for several years the number of highway accidents have been considerably less proportionately, than in the sections where there is a wider divergence in the codes that are in force.

"Not only will uniform traffic laws eliminate to a large extent the accidents resulting directly from confusion in traffic control methods," says the statement drawn up by officials of the City Officials' Division, "but they will also facilitate the movement of traffic in and between the cities."

"Practically the only deterrent to the adoption of the proposed uniform codes everywhere throughout the country, is the fact that traffic officials in some of the cities are confident that the system under which they have been operating is the best. Good traffic codes are undoubtedly in effect in many cities, and in some cases a local situation necessitates traffic regulations that will cover conditions peculiar to a particular city. In general, however, the uniform codes can be adopted with economy and profit by all cities and states and with the clauses covering the peculiar local conditions remaining as they are."

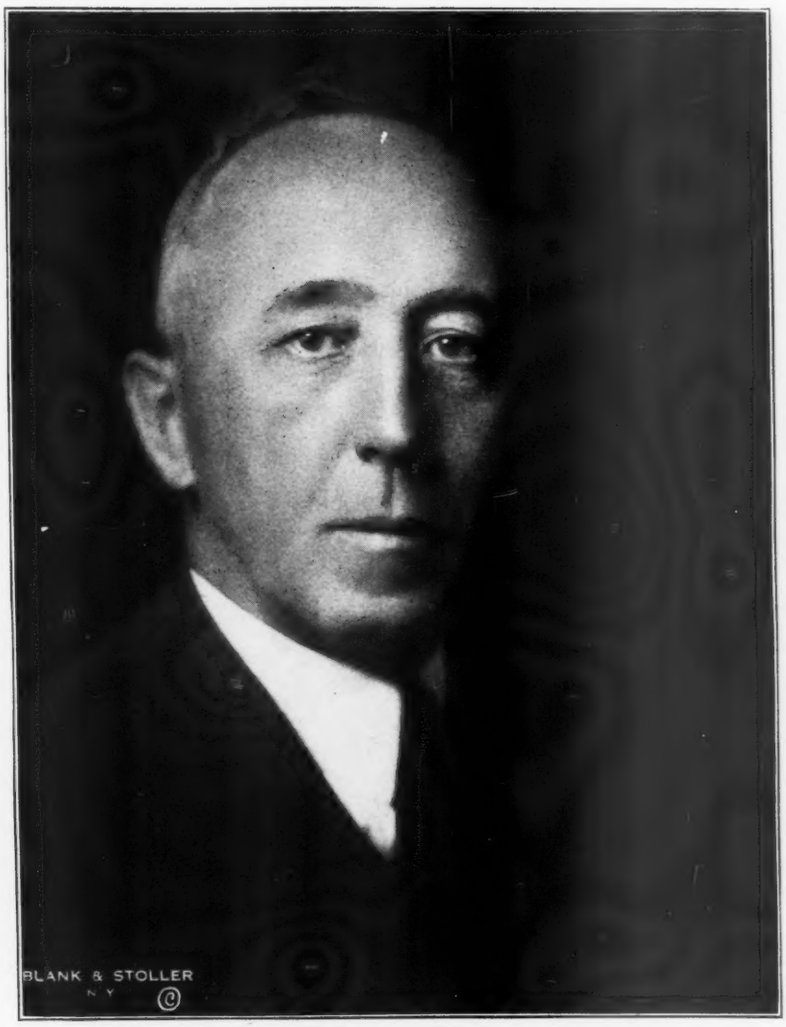
MEXICO PLEDGES SUPPORT OF PAN AMERICAN HIGHWAY

PLEDGING the support of the Mexican Government towards the construction of a Pan American Highway Luis Montes de Oca, Secretary of Finance, today told the delegates to the Second Mexican National Highway Congress and Exposition that it would not be more than three years before such a highway could be completed. "Conditions in Mexico are better than they have been for many years," he declared. "The construction of such a highway would mean the cementing of a closer bond between Mexico and the United States and would result in hundreds of thousands of American tourists annually to the Mexican capital."

Delegates from twelve Latin American countries officially opened the Congress, the outstanding feature of which was the largest exhibit of highway construction equipment ever held and second only to the annual convention and road show of the American Road Builders' Association which annually attracts approximately 25,000 highway engineers from forty countries. President Calles officially opened the first session of the Congress, at which time Octavio Dubois, President of the Mexican Highway Commission, was formally notified of his appointment as President of the Pan American Division of the American Road Builders' Association.

MEN OF THE INDUSTRY

The portraits printed on this page in each number of PIT and QUARRY are taken from our files and their selection is without significance as to current events or as to the position of the individual in the industry.

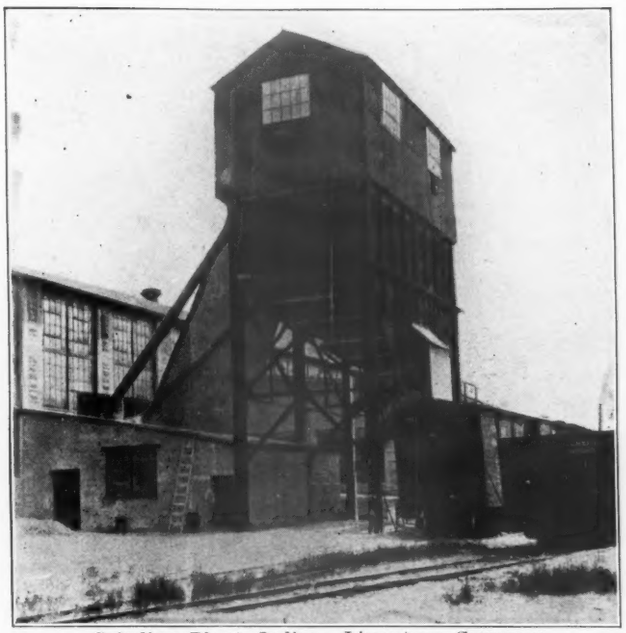


Paul P. Bird

Mr. Bird is President and General Manager
of the Boston Sand and Gravel Company
of Boston, Massachusetts

UTILIZATION OF WASTE STONE IN SOUTHERN INDIANA LIMESTONE DISTRICT

THE Southern Indiana limestone district between Bloomington and Bedford consists of a large deposit of well known and valuable building stone. Known to the trade as "Bedford" limestone, it ranks among the best natural building stones in the world, but its quarrying and preparation for use entails an immense amount of waste. It is quarried in large blocks and each block must be perfect, without seams, holes or faults. Where the prospective covering is thin or absent, the top of the stone is weathered and has mud seams, and this faulty stone is rejected. Besides weathering, the channelers and drills produce some waste, and if the work is not well done, irregular breaking of the blocks causes more loss. The total quarry waste varies according to the type of stone in the quarry and the type of stone desired. In general, however, the average is about 50 per cent. In the mills, smoothing the surface and cutting the stone into blocks causes less waste, but even here, after the blocks are received from the quarry, it averages about 20 per cent.



Grinding Plant, Indiana Limestone Company

In the early days the operators introduced wasteful methods which have been retained in part. The transportation problem formerly tended to confine the industry to a small section, and this curtailed the possibilities of utilizing the waste. Also, the operators were primarily interested in the cut stone business, and their only concern with the waste was how to get rid of it with the least trouble and expense. Within recent years, better railroad facilities and more vigorous merchandising policies have extended the market, but this increased output has not been followed until recently by a corresponding improvement in production methods, nor a proportionate development of by-products. Old methods and machinery have been retained, and the piles of waste have grown higher.

The more progressive stone men, before the advent of the Indiana Limestone Company which entered the field in 1926 through a merger of many of the mills and quarries, had made a beginning in the profitable use of waste stone in the production

Showing Uses of Part of the Byproduct of a Limestone Plant Quarry

View of Mill C. Bedford Stone

of pulverized limestone, quicklime, for fluxing material in steel furnaces, as rip rap for flood protection, and for railroad ballast. But progress was slow, hampered by transportation facilities, manufacturing problems, a limited market, and the absence of any definite plan to develop the by-products side of the business.

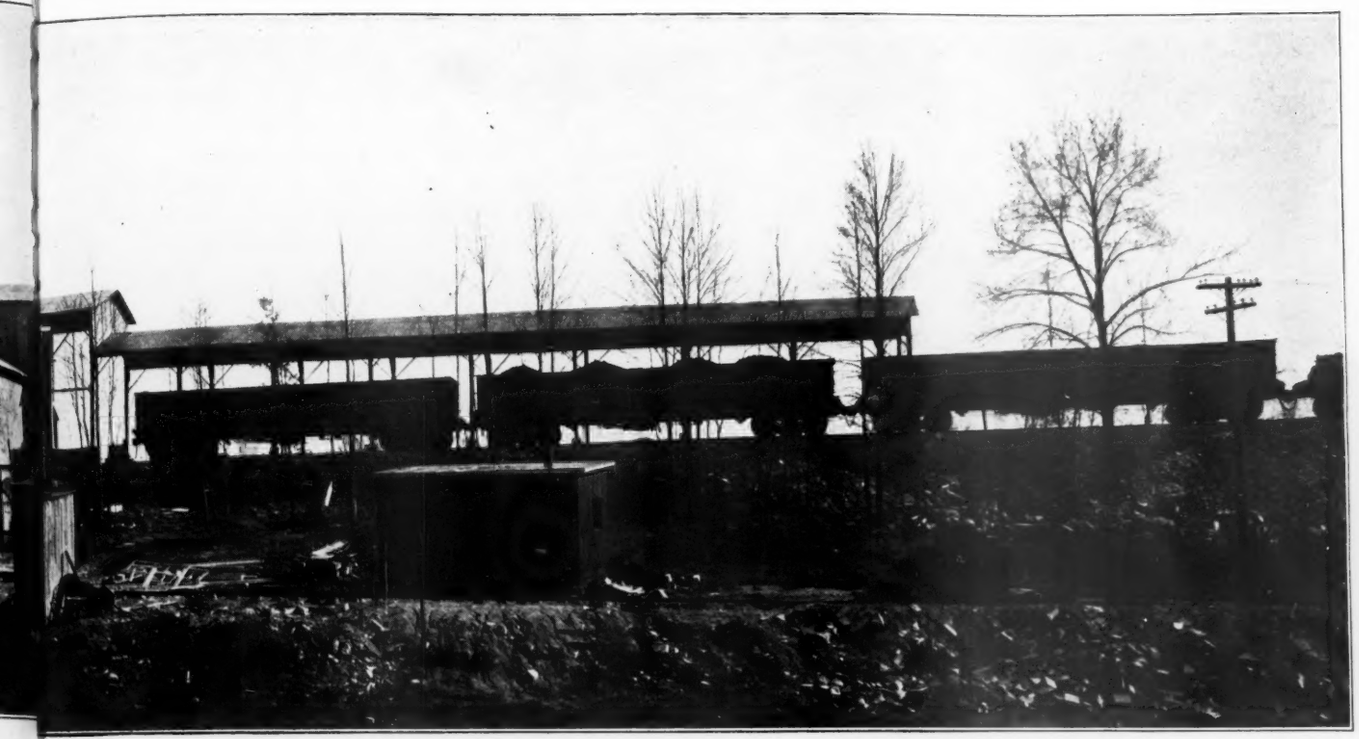
In 1927 the waste from the 30 quarries of the Indiana Limestone Company amounted to approximately 8,000,000 cubic feet. The mill waste for the same period in the 25 cut stone and 12 saw mills operated by the company was approximately 1,200,000 cubic feet. Recognizing the necessity of utilizing this immense amount of waste the company in September, 1927, established a by-products department in charge of John G. Drummond, an experienced engineer, formerly with the National Lime Association, Washington, D. C. He is assisted by E. C. Johnson. Mr. Drummond started out with the idea of using everything about the quarries and mills of the Indiana Limestone Company except the noise. And he has already made a brave start toward accomplishing this aim. Ten months after taking charge he was able to report that most of the mill waste was being sold in one form or another, and at a profit.

String of Cars Loaded with Mill Waste, Indiana Limestone Company

Because of its enormous amount and the limited demand, it has not been possible within that time to find a market for all of the quarry waste. The only outlet developed at this time is for rip rap and for use in the company's lime plant near Oolitic. Research work is being carried on and other outlets and products are being investigated with the ultimate aim in view of creating an active demand, not only for all the current waste produced in the quarries and mills of the Indiana Limestone Company, but also to dispose of the waste that has accumulated during past years. The independent operators also are using a large part of their waste stone in by-products.

Some expense is incurred in the disposal of mill waste. The cost of quarry waste disposal is practically nothing as it can either be stacked or dumped in an old quarry hole, preferably the latter. The exact amount of waste utilized in by-products manufacture in 1927 is not available. The present trend of this department indicates that for 1928 all the current mill waste will be utilized in the various by-products channels and a much larger percentage of the quarry waste will be used than ever before.

This stone has a very high percentage of calcium carbonate—more than 98 per cent—and it is for that reason an excellent material for soil correction and quick lime and for flux in steel mills. Pulverized limestone is used for flux in glass factories and a large variety of other industrial uses. The coarser stone has been used for rip rap to some extent for many years.



Products Company, Bedford, Indiana, 60 Tons per Hour

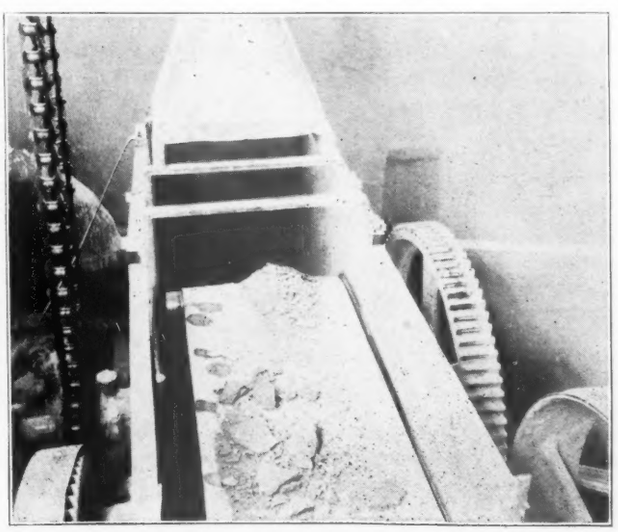
Pulverized Limestone

Pulverized limestone has been used for correction of acidity in soils for many years, but only within recent years has it developed into an important by-product. It is also used for flux in glass manufacture and other industrial uses. The chemical composition of this limestone makes it quite well adapted to the manufacture of glass, since it has a high percentage of calcium carbonate and contains only traces of iron and aluminum. There are three plants in this district producing pulverized limestone—the Bedford Stone Products Company, the Bedford Ground Limestone Company and the Indiana Limestone Company.

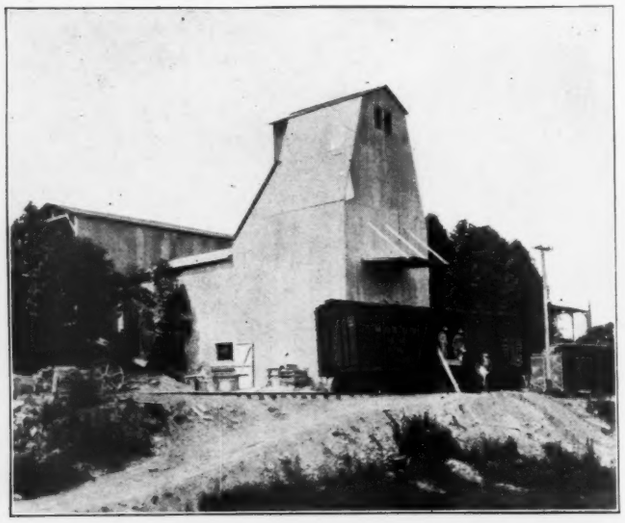
The Bedford Stone Products Company was the first in this district to grind stone for agricultural and industrial use. The plant at Oolitic, two miles north of Bedford, was established by John Laughlin in 1911. It is housed in a frame building occupying about 2,000 square feet. The demand for the product grew at such a rate that the plant has been enlarged twice to increase the output. The present plant represents an investment of around $20,000, with an average output of approximately 160 tons a day. Its maximum capacity is 200 tons a day.

John Laughlin is the pioneer ground limestone man in this section and probably was the first man in the vicinity to make any extended use of waste limestone. He began producing pulverized limestone for agricultural use at Williams, Indiana, where he established a stone crushing plant in 1907. He sold this plant in 1911 and the same year erected his present plant at Oolitic. At his Williams plant he supplied crushed stone for road construction and his pulverized limestone was incidental—a by-product of the crushed stone business. It was obtained by a Cyclone dust collector. When he started the plant at Oolitic his product was recognized as a clean, high calcium pulverized limestone. One of his earliest customers was the American Window Glass Company at Hartford City, Indiana.

Having complete knowledge of the merchandising end of the pulverized limestone business, Mr. Laughlin has a contract with the other two producers to dispose of their entire output. This runs about 110,000 tons a year, of which about 65 per cent is sold to glass factories and other industries, and about 35 per cent to farmers for soil correction.



Conveyor Belt Carrying Waste Stone from Mill to Crusher in Grinding Plant of Indiana Limestone Company



Plant of Bedford Ground Limestone Company

The maximum capacity of the three plants is about 160,000 tons a year. The Bedford Stone Products Company plant at Oolitic will produce 60,000 tons, the Bedford Ground Limestone Company plant 60,000, and the Indiana Limestone Company plant about 40,000 tons.

The Bedford Stone Products Company plant employs seven men and operates the year round. All machinery is electrically operated and power is furnished by the Indiana Public Service Company. Stone is obtained from mills of the Indiana Limestone Company located in that vicinity. A considerable quantity of planer chips comes from a Giant planer located nearby, which squares up large blocks of stone before shipping, thus saving freight charges on long shipments. Stone from the mills is shipped in railroad cars and unloaded into the crusher by hand. From the planer it comes by underground belt conveyor to the pulverizer.

Mill waste only is used. For a few months during the war when the mills were shut down and no mill waste was available, some stone was taken from the piles of quarry waste, and this was entirely satisfactory, although slightly more expensive.

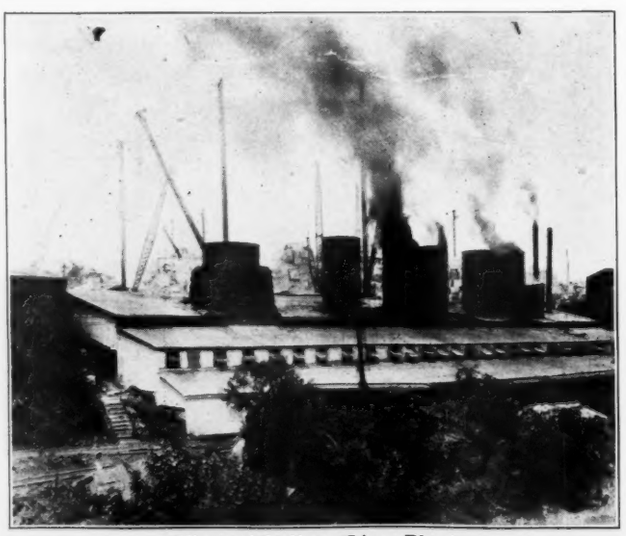
A single roll 18 by 36 McLanahan crusher is used, operated by a 50 h.p. General Electric motor. It takes "one man" sized stone and crushes it to four inches and smaller. The stone is dumped by hand from the railroad car onto a set of four T-rails laid across the mouth of the crusher. This breaks up the stone and prevents too large pieces being fed into the crusher. From there it is conveyed on an 18-inch conveyor belt to a reciprocating feeder made by the Stephens-Adamson Company. This feeder provides a regular feed and produces a uniform product. It is operated by the crusher motor, which also operates the pulverizer. The crusher has a capacity of 300 tons a day.

The pulverizer is an 18 inch hammermill unit, designed by Mr. Laughlin and built by the Bedford Foundry and Machine Company. It has a capacity of 200 tons a day. One of the original features of this plant is the use of a boiler plate in the pulverizer instead of grate bars. The plate is ¾ inch thick with ½-inch holes, 1½ inches from center to center. This feature, according to Mr. Laughlin who designed it, gives a finer and more even product and makes it possible to eliminate screens.

From the pulverizer the material goes to the storage bin on an 18-inch conveyor belt. This bin will hold three carloads, which is all the storage space required. Ordinarily the demand for this product is sufficiently uniform that it can be manufactured to supply the demand, and storing in large quantities would add too much to the expense of manufacture, in the opinion of Mr. Laughlin. To carry the material back to the end of the car, a loader specially designed to fit the needs of this plant was designed and built by local machinists. A steel spout feeds the material from the bin onto a 12-foot belt, which carries it back into the end of the car. It is mounted on two steel cart wheels, and is operated by a 3 h. p. General Electric motor.

The entire output of this plant is sold to glass factories and other industrial customers, as is also the output of the Indiana Limestone Company plant. The output of the Bedford Ground Limestone Company plant is used exclusively for agriculture. The product of the three plants is the same—90 per cent through a 10-mesh screen.

Pulverized limestone besides being used to correct acidity in soils is used for a variety of manufacturing processes, including flux for glass manufacture, certain kinds of steel fluxing, and fertilizer factories use it to neutralize excess acid in acid phosphates, making it dry and easy to drill. It is shipped bulk in box cars, except perhaps 4,000 tons a year used in the vicinity of Bedford by farmers who do their own hauling. The trade

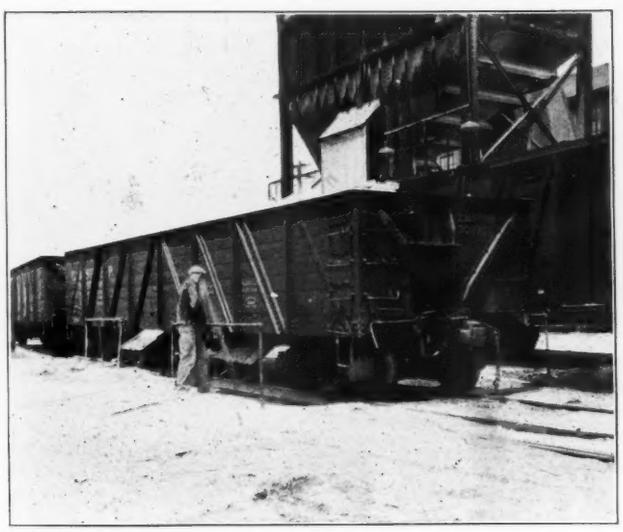


View of Indiana Lime Plant

territory for industrial uses includes Indiana, Illinois, Ohio and West Virginia. Its use in agriculture is restricted to central and southern Indiana.

All sales are made direct to the consumer. Direct mail advertising and personal calls are used to keep in touch with the industrial markets, and advertising space is used in farm papers. Mr. Laughlin also keeps in close personal touch with the county agents in sections where limestone is used for farmers.

Its use in agriculture offers the greatest opportunity for future development, says Mr. Laughlin. Practically all farm land in central and southern Indiana needs lime to correct the acidity of the soil, and only a very small fraction of this potential market has been touched. From the middle of July to the middle of October the demand by the farmer is greater than the producers can furnish, and an effort is now being made to teach the farmer to buy his supply during the off season and store



Unloading Stone in Storage Pit, Indiana Limestone Company

it until he wants to use it. This problem, which is one of the most pronounced in this industry, might be solved by providing more storage space except for the fact that the cost of handling out of storage would add too much to the cost of this low priced commodity.

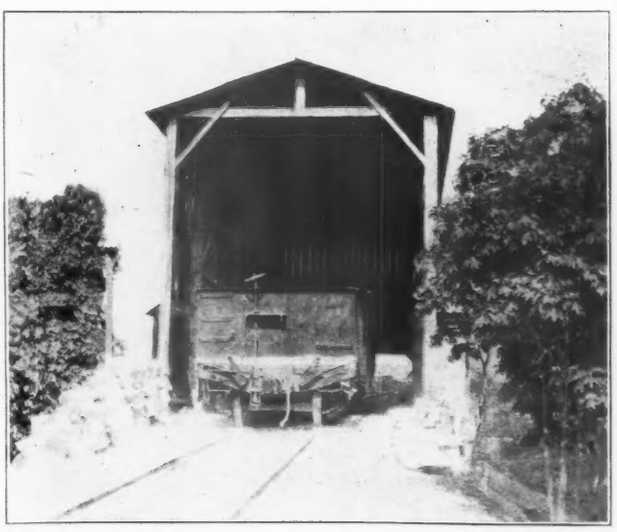
The Bedford Ground Limestone Company plant is located a mile west of Bedford, housed in a steel building. A Butterworth jaw crusher with capacity of 40 tons an hour and operated by a 25 h. p. General Electric motor is used. A hand made pulverizer designed and built by local machinists is used. It has a capacity of 25 tons an hour and is operated by a 75 h. p. General Electric motor. The material is carried from crusher to pulverizer on an 18-inch belt. From the pulverizer it is carried by bucket elevator to a cylinder screen which grades it, returning the coarse material to the pulverizer. A car loader similar in design and

Giant Planer Near Bedford Stone Products Plant. Chips Are Carried by Underground Belt Conveyor to Pulverizer

construction to the one in service at the Bedford Stone Product Company's plant is used here. Elevator and screen are operated by a 10 h. p. General Electric motor. Six men are employed during the rush season which lasts about five months.

The plant is electrically operated by individual motors. Power is obtained from the Indiana Public Service Company. Stone is furnished by the Ingalls stone mill, about 200 yards east of the grinding plant. It is loaded at the mill into railroad cars which are shunted down to the grinding plant and unloaded into a storage bin underneath the track, from which it is fed to the crusher.

Storage for the finished product is provided by two steel bins which hold three carloads. Here also more storage space could be utilized to advantage, except for the fact that rehandling would add to its cost. This plant can produce 12 carloads of the finished product in a 24 hour run. Two carloads of rough stone ordinarily will produce three carloads of the finished product. It is shipped in carload lots of about 50 tons.



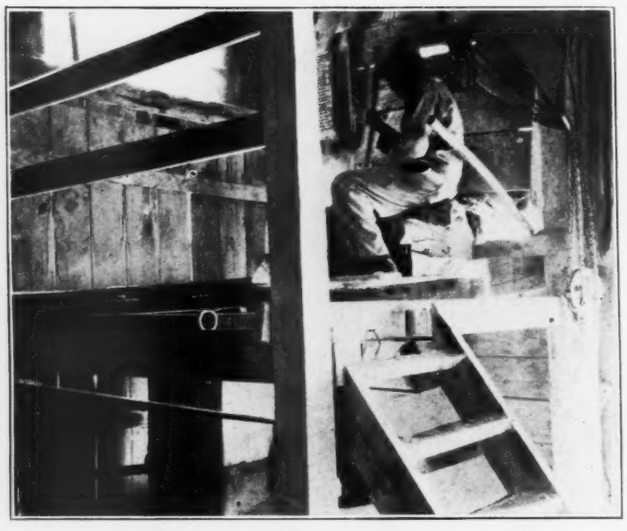
Dumping a Carload of Stone in Plant of Bedford Ground Limestone Company

Drawing Lime from Kiln, Indiana Limestone Company

The most modern grinding plant of the three is the one established recently by the Indiana Limestone Company for the purpose of utilizing waste stone from the company's mills in Bedford. This plant, housed in a concrete and steel building at the end of the Dickinson stone mill in north Bedford, was put in operation in 1923. It has a maximum capacity of 150 tons a day and represents an investment of approximately $75,000, including building and machinery.

The building is 16 feet wide, 32 feet long and 60 feet high. One-man size stone and under is delivered to the crusher from the Dickinson stone mill by a continuous belt which passes through the mill. Stone also is shipped from other mills within the switching limits of Bedford, in dump bottom railroad cars. The car is spotted over a concrete unloading pit, 30 by 15 feet, and dumped. Although it requires some hand labor to dislodge all the stone, in general this operation was intended to be automatic, and it requires a minimum of hand labor.

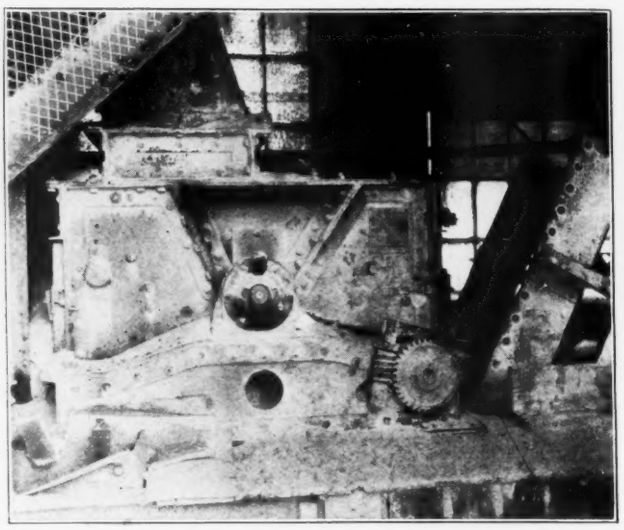
A concrete tunnel, 65 feet long, leads from the unloading pit to the mill conveyor belt. The stone is carried from the unloading pit through the tunnel and delivered to the continuous belt by a pan conveyor, operated by a 7½ h. p. General Electric motor.



Feeding the Pulverizer, Bedford Stone Products Company

A Pennsylvania 30-inch roll crusher is used, operated by a 40 h. p. General Electric motor. It takes stone up to a cubic foot in size and reduces it to two and a half to three inches. This crusher is entirely automatic. Its capacity is 15 tons an hour. It is located in a concrete pit, 16 feet deep, eight feet wide and 10 feet long.

From the crusher the material is conveyed to the pulverizer in a short elevator, 25 feet long. A Pennsylvania Hammermill pulverizer with 30-inch cylinder is used, operated by a 150 h. p. Fairbanks Morse motor. It has a capacity of 15 tons an hour. The pulverizer also is automatic and feeds direct from the crusher. It reduces the stone to ⅛-inch mesh and finer.



Pulverizer in Grinding Plant of Indiana Limestone Company

From the pulverizer the material is carried by a bucket elevator, 40 feet long, to the screens. This elevator has 64 steel buckets. It is operated by a 20 h. p. General Electric motor. Two Hummer shaker screens, with capacity of 15 tons an hour are used to screen the material. These screens are also entirely automatic. Only one grade of material is produced—⅛-inch mesh and finer. The screens grade it to this size, and return the coarser material to the pulverizer.

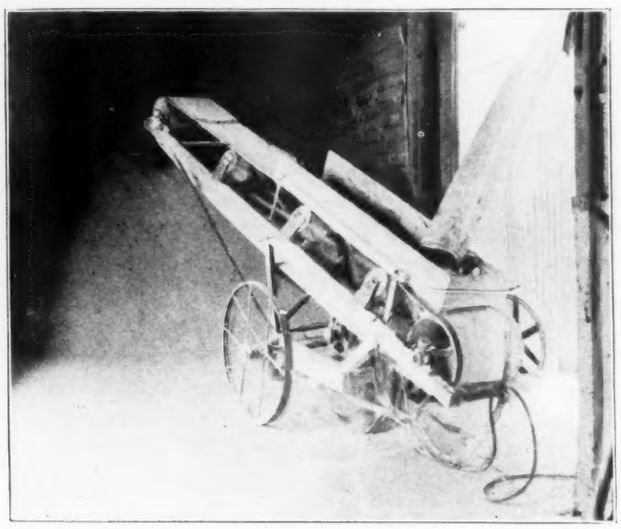
From here the finished product is fed by chute into two storage bins of 150 tons capacity each. From the storage bin the material is loaded into cars and trucks by steel chutes. A switching track is located alongside the building for railroad cars. The loading is facilitated by the use of a small car loader, similar in design to those used at the other grinding plants. It was designed by the men of this plant and made in the machine shop of the Dickinson mill. It consists of a continuous belt driven by a 3 h. p. motor, mounted on a light cart

wheel truck. The material from the chutes is deposited on this conveyor belt which carries it back to the end of the car. This loader is light enough to be handled by one man.

Five men are employed by this plant which operates the year round. One man unloads the cars, one attends the conveyor belt, two men are used around the pulverizer and screens and one man takes care of loading cars and trucks.

Quick Lime

The lime industry in the Bedford stone district is not as flourishing as might be supposed considering the amount of high grade stone available. There are many abandoned old style kilns scattered over the district, bearing testimony to past efforts made to develop this branch of the stone industry. This tardy development is due to the high freight rates on coal for fuel and the finished product; and the competition of modern plants in other sections.



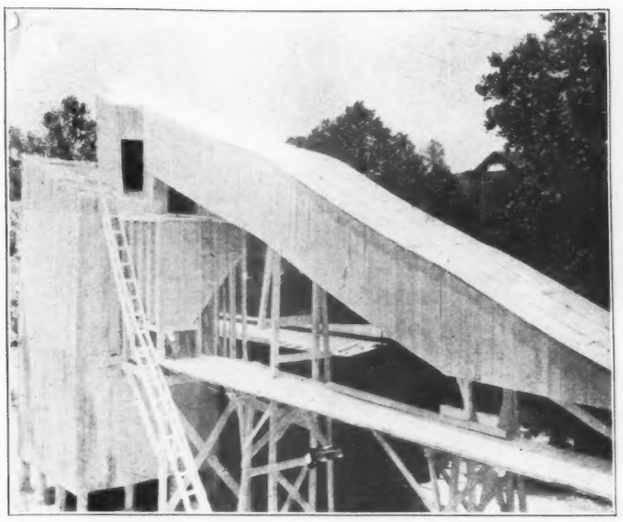
Car Loader Used by Bedford Stone Products Company

The waste stone in this district, both Mitchell and Bedford, is composed of nearly pure calcium carbonate—more than 98 per cent—and it produces a high grade quick lime, with available CaO above 90 per cent. This product is known as a high calcium lime as compared to magnesium lime, made from a limestone containing magnesium.

The chemical analysis of the quick lime produced by the Indiana Limestone Company plant near Oolitics is:

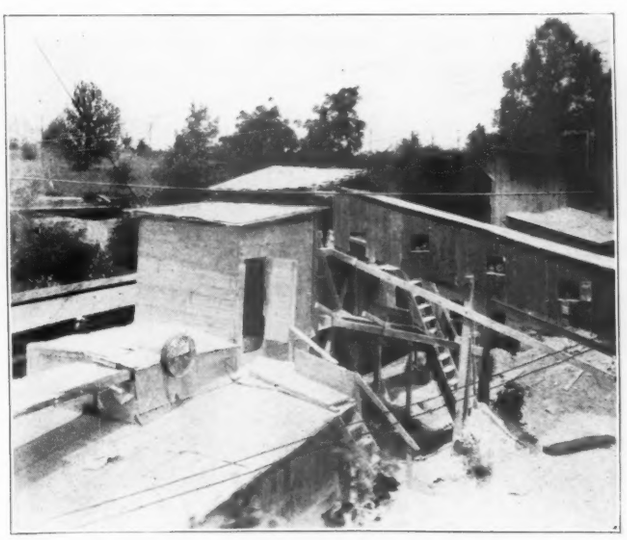
CaO	98.01
MgO	.59
Fe_2O_3, Al_2O_2	.41
SIO_2	.87
CO_2	.24
SO_2	.19
Loss on ignition	.34

Only two lime plants operate in this section. The Lehigh Lime Company at Mitchell, Indiana, operates its own quarry. The other, owned and operated by the Indiana Limestone Company, uses mill and quarry waste and is strictly a by-products plant. It is located in the old workings of the P. M. & B. quarry, two miles north of Oolitic, and the stone comes from the mills and quarries in that vicinity. Mill spawls also are used from some of the company's Bedford mills. The plant is under the direction of Audie Carter who has had 23 years' experience in the manufacture of lime and who has been superintendent of this plant since 1911.



Elevator and Storage Bin, Bedford Stone Products Company

The equipment of the plant consists of seven kilns of the continuous type, one of stone and six of steel construction. These both operate at about the same efficiency according to Mr. Carter, but the steel kilns cool off more quickly for repairs. They are 42 feet high from the fire grate to the top of the kiln. The stone kiln is six feet and the steel kilns are seven feet in diameter. The total maximum capacity of this plant is 500 tons a week, with an average production of around 400 tons.



Pulverizer House, Bedford Stone Products Company, with Conveyor

Crusher in Plant of Bedford Ground Limestone Company

The kilns are operated continuously day and night, three shifts of eight hours each being used to keep them going. The plant furnishes employment for about 27 men, most of whom are on piece work.

This plant was built in 1898 for the purpose of utilizing waste stone. The original operators were Darbin & Jones. Later it was sold to the Ohio & Western Lime Company, and then to the Indiana Quarries Company, operators at that time of the P. M. & B. quarries and mills. In June, 1926, it was sold to the Indiana Limestone Company, the present operators.

Some of the stone is obtained from a mill located just across a switch track. In the mill yard the waste is collected in wooden dump boxes holding about 5½ yards and carried by derrick to the breaking yard where it is dumped and broken up and prepared for the kilns. A considerable amount of stone from other mills and quarries in that vicinity, and some mill waste from the Bedford mills is delivered in railroad cars and unloaded by hand into the breaking yard.

In the breaking yard the stone is broken up into pieces about 4 by 12 inches and smaller. A 3,200 pound drop hammer is used for the large blocks, and smaller pieces are broken by hand sledge hammers. It is then loaded by hand into 5½-yard steel dump boxes made by the Bedford Foundry Company, then lifted and carried by derrick to the kiln. Two derricks are used for carrying stone from the mill yard and loading the kilns. About 175 tons of coal a week are used. This is Indiana coal mostly, although some West Virginia coal has been used.

After the stone has been burned, about 56 per cent of the total volume remains as quick lime, the balance being carbon dioxide and moisture passing off as gas. One ton of coal will produce approximately two and a half tons of quick lime.

Lime is drawn from the kilns every three hours by an experienced lime man. When a new kiln is started it takes about 36 hours for it to produce lime. It is drawn out into steel carts, wheeled to the front of the large kiln room and dumped on the floor, where it is allowed to cool. When sufficiently cool it is loaded by hand into steel carts and either taken to the pulverizing machine or prepared for shipping as bulk quick lime and loaded into cars.

This plant manufactures quick lime only, and no storage is required as shipments are made daily. Three grades are produced—lump, crushed and agricultural lime. The crushed lime is produced by placing the lump lime on a conveyor belt which carries it to a Sturtevant gyratory crusher with a capacity of 10 tons an hour and operated by a 10 h. p. General Electric motor. This crusher reduces the material to sizes ranging from walnut size to marble size and finer. From the crusher it is loaded directly into the car by conveyor belt. Both crushed and bulk quick lime are shipped in bulk carload lots in an airtight box car, lined with paper. Plans have been made to install an American pulverizing mill, which with a centrifugal separator will produce a pulverized lime, all of which will pass through a 50-mesh screen.

The difference between quick lime and the hydrated product is a technical question and choice between the two depends upon the use for which the lime is required. The CaO content of hydrate is usually around 71 per cent, while that of pulverized quick lime is approximately 95 per cent. In some manufacturing operations it has been found more economical to use quick lime than hydrate, and for this reason a market for quick lime is provided in certain processes in the manufacture of leather, glass, glue, brick, paper, textiles, paint, varnish, rubber, beet sugar, am-

Chemical Laboratory, Indiana Limestone Company

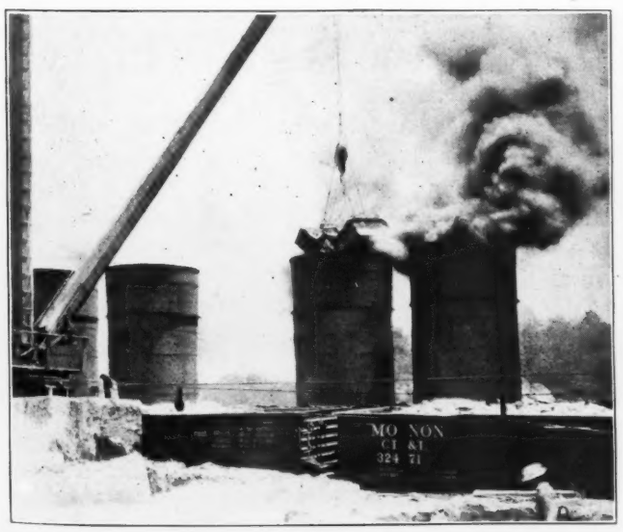
monia distillation, manufactured steel and many other commodities. With the installation of pulverizing equipment mentioned above, this company will be able to supply a high grade pulverized lime which may in some cases be substituted for the hydrated product.

One of the problems in the merchandising of this product, common to all lime manufacturers, is fluctuation in demand. Since it cannot be stored, but must be shipped out as manufactured, the manufacturing process must be regulated to supply the demand. This is accomplished by increasing or decreasing the number of kilns in operation and by speeding up or slowing down the heat. The sales end of the business also helps to meet the problem by obtaining, whenever possible, some leeway in time of delivery to the customer. It also is partially met by a general knowledge of industrial customs and habits. Glue manufacturers and water treatment customers offer an irregular demand which cannot be well determined in advance, and other customers are seasonal. A general knowledge of such characteristics of the various industries enables the lime manufacturer to forecast the demand with sufficient accuracy for all practical purposes.

The market for this product is limited to certain specified uses, but the demand and sales are increasing. The market for pulverized quick lime especially is opening up and it shows great possibilities. Sales of quick lime in 1927 amounted to about 19,000 tons. Sales in 1928, according to Mr. Drummond, give every indication of reaching close to 22,000 tons.

Flux in Steel Mills

Waste stone has been shipped out of this district for use as flux in steel mills for many years, but the amount has been small and until recently the benefit from this source was little more than that of getting the waste stone out of the way. Excessive freight rates have retarded its use in the Calumet district near Chicago, where practically all of the stone used comes in by boat from Michigan. While the Michigan stone is less expensive, for open hearth work the Indiana stone, which has a low percentage of impurities, is low in silica and magnesium and high in calcium content, is preferred.



Dumping Stone in Kiln, Indiana Lime Plant

Firing Floor, Indiana Lime Plant

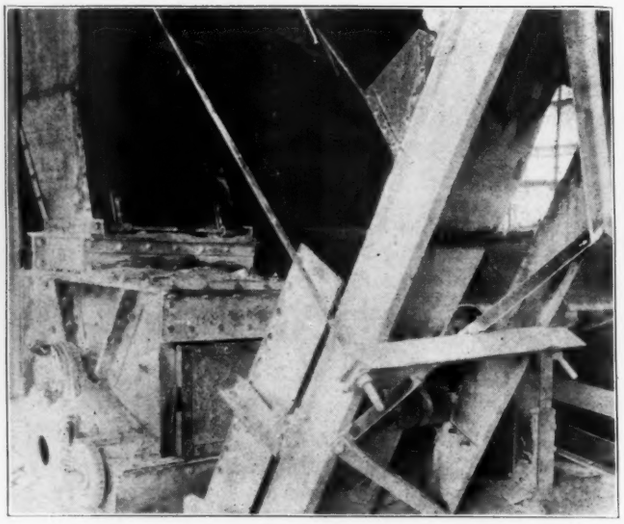
A considerable amount of Indiana limestone is being used for this purpose, and the demand is increasing. The Indiana Limestone Company in 1927 shipped approximately 100,000 tons to steel mills and paper mills, most of it going to Middletown, Ohio; Wheeling, W. Va.; Portsmouth, Ohio; and Ashland, Ky.; also some to Chicago and points in Michigan. From orders on hand and prospects, the indications are that the 1928 sales for this purpose will run close to a 20 per cent increase, or 120,000 tons.

Rip Rap

The utilization of this waste stone as rip rap, for flood protection work is of special interest because it offers an outlet for the immense piles of quarry waste. A rather small tonnage was disposed of for this purpose during 1927, but a better market is being created for it, and it is anticipated that 1928 will show a substantial increase. The Indiana Limestone Company expects to market approximately 40,000 tons for this purpose this year.

The size of stone used for rip rap varies from what is termed one and two-man stone, which usually weighs from 10 to 150 pounds, through all weights up to and including 20-ton blocks. Some of its advantages are its availability in large quantities, its size and its uniform structure. The principal markets are along the Great Lakes, where it is used by dock and dredging contractors, the Ohio river and the rivers of Indiana where it is used by railroads and goverment engineers.

Lime Drawing Floor, Indiana Lime Plant



Pulverizer and Conveyor, Indiana Lime Plant

Tennis Court Topping

The use of gang saw sludge as a top dressing for tennis courts and other surfaces, where a hard yet resilient surface is desired, has been known for many years. It is a mixture of silica, sand and stone dust saturated with water, produced at the saw mills. The material is finely ground and packs like clay, except that it is not affected by water. It has a certain amount of resilience and approaches the qualities of En Taut Caste. This material, which is strictly limited in quantity and uniform in quality, is shipped in bulk in carload lots, direct to the consumer. Its present market is confined mostly to Chicago, although some tennis courts have been made of it at French Lick, West Baden, Bedford, Indiana and Cincinnati, Ohio. Ohio State University has four courts with a top dressing of this material which are reserved expressly for Varsity play. The chief customers are landscape architects and others interested in building tennis courts. In 1927 about 100 tons were marketed for this purpose, and in 1928 the by-products department of the Indiana Limestone Company expects to double this amount.

Roads, Railroad Ballast and Concrete

The use of crushed limestone for road making, railroad ballast and concrete, offers some possibilities of waste disposal, but most of these products are made from stone taken from a quarry for that particular purpose. The Mitchell limestone is especially adapted to road building because it is very hard and has good wearing and cementing qualities. Most of the roads in this section are macadamized, although an increasingly greater mileage is being built of concrete. The Indiana Limestone Company does not produce any crushed stone.

Railroads that have used the Mitchell limestone as ballast report that it is very successful, but the Bedford stone is too soft to make a firm bed. Some waste from the quarries and mills has been used locally for ballast, but no attempt is being made now to market it for that purpose.

As coarse aggregate for concrete work, crushed stone is entirely satisfactory and most of the concrete in this section is made of this material, produced by a number of small hand operated quarries. The finer crushed stone or screenings, also has been used for fine aggregate in the production of all-stone concrete, and this use has now progressed beyond the experimental stage.

The Bloomington Crushed Stone Company operates its own quarry about a mile west of Bloomington, where it owns a 15-acre tract and has been working a 50-foot stratum of Mitchell limestone for about 11 years. This concern produces crushed rock for road building and concrete work and a limited amount of ground limestone for agricultural use. About 100,000 tons of crushed rock were produced in 1927, practically all of it being used locally for road building and maintenance.

Portland Cement

In chemical composition and physical character the Mitchell and Bedford stones are both well fitted for the manufacture of portland cement. The Lehigh Portland Cement Company is operating a plant at Mitchell, a few miles south of Bedford in which Mitchell limestone is used. A cement mill was formerly operated by the United States Cement Company at Bedford, where Bedford stone was used with satisfactory results. Both stones have a high percentage of calcium carbonate and contain very little impurities. They are easily crushed and carry a low percentage of moisture.

The Mitchell cement plant uses shale from the knobstone formation near Brownstown and Sparksville, Indiana. Like formations also outcrop east of Bloomington, and would be available for a cement plant in this vicinity.

(*Continued on page* 61)

DEVELOPMENT OF MODERN QUARRYING PRACTICE

THE October, 1928, issue of the Du Pont Magagine contained an article on the bench and well drill methods of quarrying by S. R. Russell, explosives expert for the Du Pont Powder Company. Quarries treated in this article include only open pit operations which produce crushed stone for commercial purposes, such as limestone, trap rock, granite and sandstone.

Explosives are absolutely necessary to economical quarry practice. About 90,000,000 pounds are used annually in quarries in this country and represent about 10 to 15 percent of the total cost of stone produced. Next to labor it is the greatest item of expense in the process.

Four general methods of working a quarry face are now in use. Benching, snake holing, well drilling and the coyote or tunnel method. The particular method best suited for any quarry depends upon the character of the stone, its stratification and thickness of vein, the proposed use of the product, and preference. The churn drill, or well drill method has been accepted for a number of years as the most efficient and modern. Earlier methods used the tripod drill, operated by air or steam, and the hammer type machines.

Hand labor was also used to load the stone in earlier days and made necessary the breaking of the stone into pieces easily handled by one man. More and smaller holes were necessary to accomplish this, and the limited depth to which holes could be drilled by the tripod machines compelled the use of the bench system. This meant working a face of rock in a series of vertical steps or benches, six or more often being necessary in high faces. With the coming of the steam shovel, however, it was impossible to keep enough stone down in front of the shovel which moved about on rail sections a few feet at a time. Attempts were made to overcome this difficulty by shooting several benches at a time. This brought down more stone and lessened the moves, but greatly handicapped the shovel because it could not dig to the bottom and back of the bank of stone. Due to much of the stone remaining on the benches from previous shots a great deal of hand labor was necessary to clean them before redrilling.

The churn drill next came into favor and has held first place ever since. This machine drilled holes the full depth of the face, permitted wider spacing of the holes, eliminated bench cleanings and the dangers attached to them, and assured greater volume of stone on the quarry floor so that less frequent shovel moving was necessary. The new method, however, also had its disadvantages as it brought the stone down in bigger blocks. These had to be redrilled and blasted before the shovels could dig them and before they would fit the crusher openings.

Few plants at that time were equipped with crushers big enough to take stones that would go through a shovel dipper. The next move, therefore, was to get larger crushers, and the development along this line has been very rapid. Jaw crushers are now made with openings 66 by 48 inches, and number 60 gyratory crushers will take stones weighing several tons. This larger equipment contributed greatly to the success of the well drill method of blasting.

Well drill holes vary from 4 to 8 inches in diameter but the most common is the 5⅞ or 6 inch hole. The bottoms of the holes are usually loaded with a high strength, high density explosive such as gelatin, and a lower strength, more bulky explosive along the column in order to get the best distribution of explosives at the least cost.

Proper drilling of blast holes is necessary for successful quarry operation. Poor results obtained in blasting are usually due to improper drilling. Well drill holes must be drilled to the proper depth below the floor level and this should not be left to guesswork by the driller. The proper method of doing this is to establish benchmarks on the top of each bench with an engineer's level to be used as permanent reference points for the placing of stakes in the future. These stakes should be set at regular intervals around the quarry and far enough back to prevent disturbance, each stake being marked with the cutting at that point to indicate the depth of hole. This method will prevent any trouble arising from short holes and consequent failure to pull the bottoms.

The following table has been compiled by Mr. Russell to give the depth of sub-drilling in faces up to 200 feet high unless there is a natural parting at the quarry floor, in which case little or no sub-drilling is needed.

Height of Face	*Sub-drilling*
30 to 40 feet	3 feet
40 to 60 feet	4 feet
60 to 90 feet	5 feet
90 to 125 feet	6 feet
125 to 150 feet	7 feet
150 to 175 feet	8 feet
175 to 200 feet	10 feet

Opinion varies as to whether two or three rows of holes arranged in staggered order or a single row will give the best fragmentation, and the majority favor the latter. Mr. Russell's experience has been that the single row is best when the face of stone is over 50 feet high. Multiple rows are rarely used for high bank shots because the back of the bank when shot is too high for efficient

shovel operation and the shovel may also be endangered by slides of loose material. In faces less than 50 feet high local conditions and the character of the stone must be considered. In relatively shallow faces, 25 to 40 feet in height, two to five rows of holes are often shot at one time. In this way sufficient volume of material is gained to minimize the shovel and track movements.

The question as to which is the most economical or efficient height of face to work with power shovels has also caused much discussion. Much depends, of course, on the size of shovel in use and the kind of quarry. Many quarries are side hill operations in which the height of face is governed by the topography of the ground, some of these faces running from 100 to 250 feet in height. Few of these quarries could afford to operate more than one separate well drill bench. Conditions, therefore, in most cases govern the method of operation.

In flat country, especially in the middle west, however, most of the quarries are pits and any height of face desired can be used. Faces not more than 40 feet in height seem to be the most economical for shovels up to 110 ton weight. Mr. Russell believes that since the advent of the caterpillar shovel a face of this height or even lower can be most easily and economically operated.

Often part of the material from a previous blast is left against a face which is to be shot down to confine the force of the explosives so that better fragmentation is secured without distributing the stone over too great an area. This pile is called a "buffer" or "blanket" and the method is called "buffer blasting." A buffer is also necessary when the floor area between the track and face is limited. If the buffer is too heavy, however, the stone will not come out far enough to permit of easy access by the shovels. Drilling and blasting of large stones uncovered by the shovel will cause frequent and costly holdups.

In quarries where the stone lies in thick heavy ledges with open seams and has a tendency to slide out in large blocks before the explosive has had time to shatter them, it is best to use little or no buffer and allow these blocks to be thrown out further where they can be easily redrilled without delaying the operation of the shovel. In faces 60 feet or more in height no buffer is necessary and the material from each blast should be cleaned up before another is shot.

Much controversy has also arisen over the merits of larger holes, especially the 8 inch hole, over the 6 inch hole which is most commonly used. The advocates of the larger holes claim that the cost of drilling is very little more and that the wider spacing makes for all around economy. The cost of drilling an 8 inch hole, which, of course, requires a larger and more powerful machine, is from 25 to 30 percent greater than a 6 inch hole. The 8 inch hole will hold 77 percent more explosive than the 6 inch and should, therefore, give 77 percent greater volume of stone. Mr. Russell's experience, however, has shown that this increase is impossible to obtain in limestone formations because the material is not homogeneous and seams, faults and caves are often present which have a great effect upon the execution of the explosives. Fragmentation can only be increased by closer spacing of holes, and the maximum for limestones, according to Mr. Russell, should be about 20 feet.

Well drilling in limestone is comparatively easy and cheap, varying in cost between 35 cents to $1.00 per foot for a 6 inch hole. On the other hand, drilling in trap rock, quartzite and other hard diabase rocks is very slow and expensive and may vary from $3.00 to $6.00 or more per foot. The larger 8 inch hole would be an advantage in a case of this kind, especially in trap rock which usually breaks up better than limestone. Even if the drill space cannot be increased in proportion to the amount of explosive used 8 inch holes are usually more economical in this type of rock.

The well drill method is now and probably will continue to be the most widely used in quarries, especially those of the side hill type. There are many cases, however, especially in the pit quarries where this method of drilling and blasting is not as well suited as the shallow bench system where high speed hammer type drills are used.

Fumes Produced in Blasting

Dynamite used in underground blasting must produce the least possible amount of poisonous fumes in order that the hazard of asphyxiating workers at the face may be reduced to a minimum. In an investigation being conducted by the Pittsburgh Experiment Station of the United States Bureau of Mines, in cooperation with the Hercules Powder Company, experimental blasting tests are being made with a series of specially prepared dynamites of varying chemical composition in order to determine the mixture that produces the least possible fumes. A blast is fired in a tunnel which is bratticed off so that the gases from the detonating explosives are confined in a relatively small volume. Samples of the atmosphere in the tunnel after the blast are taken for analysis by men wearing breathing apparatus. The toxic gases produced by dynamites are found to be mainly carbon monoxide and oxides of nitrogen. The amount of these gases produced depends upon the composition of the explosive and the method of loading, factors which are being investigated by the Bureau of Mines. Modern gelatin dynamites produce relatively small quantities of fumes.

NEW WASHED SAND AND GRAVEL PLANT ENTERS FIELD IN CONNECTICUT

By F. A. Westbrook

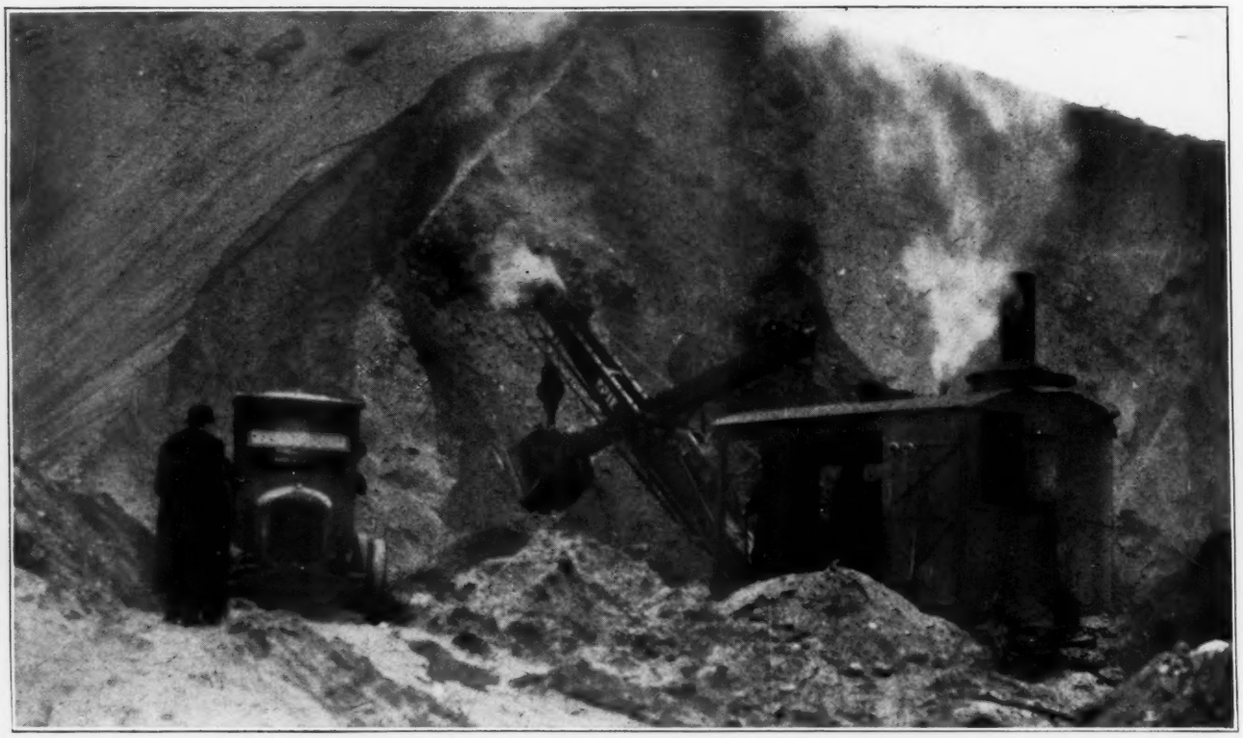
STATE specifications for sand suitable for concrete highways seem to be responsible for a good deal of new development in the sand and gravel business to judge from what is heard in the field. Until about a year ago there was very little sand produced in Connecticut which could meet the specifications of the state highway department and consequently the Connecticut Quarries Company made a survey of existing deposits with a view to developing a new plant. Heretofore the bulk of the sand had been brought from Long Island. One of the requirements, in addition to those of the quality of the sand, was that the bank should be conveniently located for railroad transportation. Such a location was found at Avon, Conn., where the deposit is directly adjacent to the tracks of the New Haven Railroad. The Certified Sand Company was therefore organized and a plant erected designed to produce 500 tons per day. The property covers 100 acres and the company has an option on more.

Truck Loading Under Sand Bins

The bank has only a negligible quantity of cobbles and washed pea gravel and sand are the only products. Material is excavated with an Erie steam caterpillar shovel which loads it into one-ton Ford trucks equipped with Ruckstell rear ends. There are three of these trucks which carry the sand to the plant, frequently making one hundred trips a day each. The trucks dump their loads over a grizzly to get rid of any cobbles that may be present, but actually these are so scarce that they do not call for a crusher. The material is then fed onto an 18-inch Robins belt conveyor, driven by a 15 h.p. Fairbanks-Morse motor, which carries it to the top of the plant and discharges it into a Robins Vibrex screen run by a 1 h.p. General Electric motor. This removes the coarse material which is used mainly for fills around the plant or is sold for the purpose when there is a demand for it.

The mixture of pea gravel and sand from the

View of Stock Piles and Railroad Siding



Shovel Loading Truck Which Carries Material to Grizzly

Truck Dumping Load Into Grizzly, and Conveyor to Washing Screen

vibrating screen next is washed through a stationary screen made of Manganese Steel Forge Rolman Manganese Steel to separate the sand and gravel. The sand and water then flow into a number 8 Telsmith settling tank. The sand, pea gravel and the oversize material drop into bins. Surplus sand passes from the settling tank through a long swinging steel spout to outdoor stock piles or directly into freight cars. A steam operated Brownhoist crane with an Owen bucket is used to load sand from the stock piles into freight cars and for making up stock piles.

Crane Hoist Loading Freight Cars from Stock Piles

Conveyor to Washing Screen, and Swinging Pipe for Distribution of Washed Sand to Stock Piles

Shipments are made almost entirely by rail. The plant being located adjacent to the railroad, it has been a very simple matter to construct a freight siding, as shown in one of the illustrations, which has been equipped with track scales. The freight cars are loaded with pea gravel from the bins but not with sand. Some material is shipped by hired trucks and these are loaded with both sand and gravel from the bins, although in this case the sand is sometimes handled with the Brownhoist.

Water for the washing operation is obtained from the Farmington River about half a mile away. A 6-inch pipe is used. The pump is a 3 HV Cameron centrifugal with a capacity of 300 gallons per minute. It is driven by a 25 h.p. General Electric Co. induction motor. The pipe line is provided with a 6-inch standard P & C gate valve and a Kennedy Valve Mfg. Co. by-pass valve. It has been necessary to construct a pole line across the fields to this pump house in order to furnish power to the pump motor through transformers at the last pole. Service wires are carried into the building through a Paiste entrance goose-neck which makes a very safe and workman like job.

The plant is very complete with a five car garage and an office building. In fact the lay-out and equipment are first-class in all respects. It seems altogether probable that the business will increase before long to a point where more equipment will be necessary.

Vibrating Screen with Stationary Screen Below

Artificial Stone

Artificial stone is made by grinding clay and sand to a meal like mass (6 parts of each), and adding cement (1 part) as well as water, if necessary to obtain a moist mass.—A. Tetzner (British Patent 292,925).

RECORDS THAT INCREASE SALES

TO the sales manager falls the responsibility of carefully watching his selling organization at every point. With a small business and few customers, mere mental knowledge may serve, but as an organization grows the selling executive becomes more and more dependent on his clerical records of customers. According to the value of the information they contain, he is able to manage his department with success or otherwise.

One large concern which has customers throughout the country uses a system of records that has proved its worth in increasing sales. The business is done both direct and through salesmen, who are allotted distinct areas. For every locality in a salesman's ground, a special card is kept (Form 1) on which are recorded the name of the city, town or locality, number of prospective customers, the salesman's name, and the date the card was brought into use. Spaces are also provided for records of visits during each month of the year, and the result. The body of the card contains a list of actual or possible customers in the town or locality with their trade, average amount purchased, credit, and the date and amount of the last sale to each.

These cards are opened each year, and the total of the last year's sale for the section is first entered, together with the amount expected during the current year. The total sales taken in conjunction with the total customers shows the percentage sold, and there is a fixed minimum below which these must not go. Above the minimum, no special pressure is put on a locality, but if sales fall below the minimum required, it is given special attention.

These cards are filed geographically, and when a salesman begins his journey, his cards for the district are taken from the file and put into a loose-leaf binder which he carries with him. From the cards, therefore, he can see exactly how many firms must be called upon and what is expected of him.

Supposing a district has given $15,000 worth of business during the year of 1927 and $18,000 was expected for 1928, the salesman would know (presuming that he makes six visits a year) that unless he got $2,500 worth of business at each visit, he would be behind his quota. This has a stimulating effect on the concern's salesmen as knowing what is expected of them, they can make the best of their opportunities in order to secure it. Details of visits and results are posted to the monthly spaces of the card from the salesman's daily reports, so that a permanent record is kept of all visits made. In addition, these records are analyzed separately for office information, in order to show the attention each salesman is paying to the various districts in his territory and with what results.

Another card is also kept for the various districts in the country (Form 2) which shows both the general and salesman's business for the district

Co. Year

Month	General		Salesmen		Month	General		Salesmen	
Jan.					July				
Feb.					Aug.				
Mar.					Sept.				
Apr.					Oct.				
May.					Nov.				
June					Dec.				
6 Months Total					6 Months Total				

Year General
" Salesmen
" Total

FORM 2

Territory _____ Co. _____ Salesman _____

Section _____ Date of Card _____

This Territory Has Previously Yielded $_____ Expected 1928 $_____

O Visits and Results 1928	Jan.	Feb	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.

Firm	Address	Trade	Amount Purchased	Credit	Last Sale	
						Amount
O						

FORM 1

Territory District

Name Co.

Address Ret. Who

Day	Month	Year	Amt.	Day	Month	Year	Amt.	Day	Month	Year	Amt.	Remarks

FORM 3

Advertising Matter Supplied

Date	Quan.	Kind	Date	Quan.	Kind	Date	Quan.	Kind

FORM 4

for each month in the year. This classification is valuable because it again shows whether the salesman is bringing in his proper share of business. Faced with this record (if the general sales are more than his own) a salesman has no excuse for his own failure and unless he can bring in his proper quota of business, or develop it, he has to explain the reason.

For every customer on the firm's books, a separate customer's card is kept (Form 3) which gives particulars of name and address, and other details. On this card are entered the date and amount of every purchase made during the year. This in addition to the ledger records; and for reference purposes the cards are used instead of the ledgers. At the back of the cards a record of all advertising supplied is also kept, so that the complete record shows at a glance what a customer is doing, and what use he is making of the facilities for advertising supplied him, any question regarding a customer is answered by referring to these cards. Constant reference to the ledgers wastes time, whereas the cards give concentrated and valuable information in a convenient form.

From these sets of cards valuable details are extracted for analysis purposes which afford the sales manager accurate knowledge of every detail of the business and its operation, and enables him to direct it to the best advantage.

Code of Ethics and Marketing Policies of Ohio Lime Association

The Finishing Lime Association of Ohio has recently issued a booklet concerning the classification of lime together with a code of ethics and marketing policies of the members of the Association.

The formation of a code of ethics and marketing policies is a result of a consciousness on the part of the members of The Finishing Lime Association of Ohio, that the sale and distribution of building supplies represents the most intense competitive field that exists in our commercial life today. Further, the members realize that if the present system of distribution is to survive, that the dealer must have a fair return of profit upon his investment, and the formation of The Finishing Lime Association and the inauguration of marketing policies mentioned above represent their efforts to bring about a spirit of fair play and cooperation.

The Association is made up of the leading manufacturers of Finishing Hydrated Lime from Ohio, and one of the requirements for membership is that the manufacturers' product meet the current specifications of the American Society for Testing Materials.

The Gibsonburg Lime Products Company of Gibsonburg, Ohio, has recently become a member of the Association, and operates a modern lime plant at Gibsonburg, Ohio. This addition to the Association membership strengthens it, and it is now one of the most highly organized industries serving the construction field.

The membership is as follows:

The Kelley Island Lime & Transport Co., Cleveland, Ohio.

The Luckey Lime & Supply Co., Luckey, Ohio.

The National Lime & Stone Co., Findlay, Ohio.

The National Mortar & Supply Co., Pittsburgh, Pa.

The Ohio Hydrate & Supply Co., Woodville, Ohio.

The Woodville Lime Products Co., Toledo, Ohio.

The Gibsonburg Lime Products Co., Gibsonburg, Ohio.

Cuban Central Highway Construction Going Forward Rapidly

The 705 miles long Cuban Central Highway which runs from Pinar del Rio in the western part of the island to Havana and on to Santiago, passing through the capitals of six provinces on the way, will be finished within three years, according to Warren Brothers Company, international contractors. The road when completed will have no grade crossings and no speed limits outside of settled communities.

This road will be open to American tourists by a six hour auto ferry to Havana from the end of the recently completed Overseas Highway at Key West, Florida, which was described in the July 18, 1928, issue of Pit and Quarry. Running as it does through the central part of the island with its rugged mountains and magnificent foliage, this highway will be one of the latest scenic drives.

The road is being paved over its entire length 20.66 feet wide with 5.64 foot shoulders on each side. The type of pavement being laid consists of 12 inches of crushed rock over which portland cement concrete is poured to a thickness of 6 inches in the center and 9 inches at the sides. With the exception of granite block paving on a few sections it is being overlaid by 2 inches of Warrenite-Bitulithic, which provides a shock absorbing surface. Many embankments, cuts, and fills are included in the project. When it is completed laterals will be built to the various Cuban ports and coast cities. The entire cost of the project will be about $75,000,000 and will average about $106,000 per mile. Construction is now going forward night and day in many sections.

Actual starting of the construction was largely due to the efforts of President Gerardo Machado of Cuba and Secretary of Public Works Cespedes. The Warren Brothers Company has a contract for about 500 miles of the highway, which is being built under the direction of Horace W. Ash, vice-president of the company. W. C. McDonald is in charge of construction and is assisted by I. B. Stafford.

OREGON CRUSHED STONE PRODUCER BELIEVES IN SIMPLICITY OF PLANT LAYOUT

THE W. D. Miller Construction Company of Klamath Falls, Oregon, operates two crushed stone plants. One of these, which is a large producer, is located at Klamath Falls and one, a temporary unit, is at Midland, Oregon. The company is at present engaged in opening an additional permanent quarry about four miles from Klamath Falls on the Klamath Falls and Ashland Highway. A completely equipped crushed stone plant, adjacent to the quarry, is being erected and will be in operation to remain a permanent producing asset to the community.

For the past five years, the W. D. Miller Construction Company has been operating a quarry at Pelican City, about three miles from Klamath Falls, and located on the Southern Pacific Railroad. A sidetrack has been laid for the benefit of the Construction Company which is reached by a 200 foot belt conveyor. A chute has been provided to permit of loading the railroad cars.

At present, this quarry is furnishing about 40 yards of rock for state highway construction, besides furnishing local contractors and shipping the remainder of the product. Much of the stone for the highway is loaded into cars and shipped to a siding, adjacent to work, and unloaded with clamshells and cranes into temporary bunkers. It is then hauled from the bunkers to the highway and stock piles provided for use on road construction. Four stock piles, which have an excess of 15,000 yards of material, are maintained that are made by unloading railroad cars.

At Pelican City, the rock is a close grained black syenite, easily quarried and well adapted for concrete aggregate and road construction. Due to the rock formation, which is in layers, it is coyoted and but little bulldozing is required to prepare it for loading with the shovel. The rock is loaded into cars by a model 200 P and H shovel, built by the Harnischfeger Corporation, that carries a 1½-yard bucket and is operated by a 50 h. p. motor. The cars are attached to a cable and taken up the incline with power furnished by an electric hoist. They are dumped on to a grizzly where much of the foreign material is separated from the stone and carried by a belt conveyor to the refuse heap.

Rock passes from this grizzly into a type A 24 by 36 Blake jaw crusher, supplied by the Traylor Engineering and Manufacturing Company. It then flows by gravity from the jaw crusher over a grizzly and on to a conveyor belt to the rock screens, where it is separated into the different sizes and passes into the bunkers which have a capacity of approximately 200 cubic yards. Rejects from the second grizzly pass through a 3 foot Symons cone crusher and to the belt conveyor for transporting to the rock screens and passed with the finished product through to the bunkers. Directly under the bunkers, a 200 foot belt con-

Starting to Load After the Blast with Shovel in Action

Portraying Results of Tunnel After Blast

Showing Coyote, or Tunnel, Before Blasting

Results of Another Ordinary Blast

veyor operates to carry the rock to the cars on the railroad siding.

At Midland, Oregon, the temporary plant consists of a 24 by 36 roller bearing jaw crusher, and a 24 inch Symons disc crusher for secondary crushing. This plant has a capacity of 250 yards per day which is being used for highway construction on the road between Klamath Falls, Oregon and Weed, California, of which the W. D. Miller Construction Company has the contract for nine miles.

Uses of Graphite

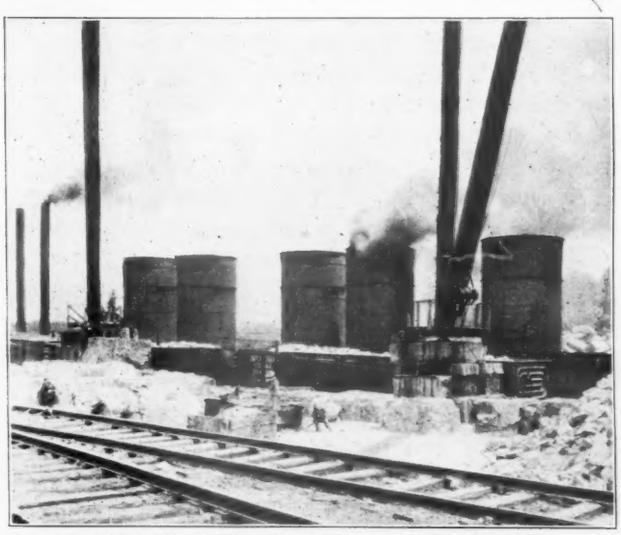
Natural graphite is used chiefly in the manufacture of foundry facings, pigments and paints, crucibles, pencils, commutator brushes, stove polish, lubricants, retorts, and batteries, says the United States Bureau of Mines, Department of Commerce. During the last few years the use of graphite in the United States has undergone radical changes. Uses that a few years ago consumed a large proportion of the supply are now relatively of minor importance, and uses which were unimportant have become important. Before the World War the manufacture of graphite crucibles consumed more than one-half of the supply; in 1923 only 15 per cent of the graphite used in the manufacture of finished products was used in the manufacture of crucibles and in 1924 only 13 per cent. Foundry facings used only 10 per cent of the graphite in 1913; the quantity so used in 1923 was 44 per cent, and in 1924 it was 52 per cent. Other uses that were minor before the war and are now of much importance are in pigments and paints, pencils and crayons, commutator brushes, stove polish, and lubricants.

Graphite is manufactured at Niagara Falls, N. Y. This branch of the industry was started in 1897, under patents obtained by Dr. E. G. Acheson, and was developed so rapidly that after 10 years the production of artificial graphite exceeded that of natural crystalline graphite. Since 1910, except for 1915 and 1920, the output of manufactured graphite has exceeded annually the combined output of domestic amorphous and crystalline graphite.

(*Continued from page* 50)

Chemical Laboratory

One of the interesting recent departures in an effort to really solve the problem of waste disposal for all time to come and place the by-products department in a commanding position so far as merchandising the products is concerned, is the establishment by the Indiana Limestone Company of an experimental chemical laboratory. This laboratory, located on the second floor of the office of the Thornton mill in Bedford is conducted by Lee Huber, a chemist with experience in industrial work. Routine analyses are conducted on lime to maintain the standard required by customers using chemical lime, pulverized stone is analyzed to help the producers maintain a constant quality, and experimental work is conducted on further development of present by-products.



Breaking Yard Showing Kilns, Indiana Lime Plant

MATERIAL RECORDS AND CONTROL

By J. J. Berliner

IN ORDER that material may be properly safeguarded and accounted for, it is essential that there be the proper organization. Every plant of moderate size should have a storeroom organization which should consist of a storekeeper in charge of the department; a stores ledger clerk who keeps a record of materials received and issued; and a sufficient force of keepers to handle incoming materials, place them in their correct storage places, issue them as direct, and keep such records and inventories as are needed.

The storeroom should be properly arranged with bins or spaces to take systematic care of the material and the storekeeper in charge should be responsible for all materials placed in his care, and for the efficient operation of the storeroom. It is the duty of the storekeeper to see that the materials delivered to the storeroom by the receiving clerk are deposited in storage and remain there until required. No materials can be taken from the storeroom except when properly authorized through a stores requisition. At frequent periods, it is the duty of the storekeeper to take inventories of the stock on hand so that the actual physical inventory taken may serve as a check on the perpetual inventory indicated by the stores ledger.

The control of the storeroom should be vested in the production department, as the control of all material movements is one of the most important functions of production control. The stores ledger clerk who is in charge of the store's ledger and is responsible for the correct recording of transactions dealing with the amount of material received by the storeroom, the amount issued to the manufacturing departments, and of inventory of materials on hand should be located therefore in the production department and not in the storeroom. In this way, the store's records are readily available for the use of the production department in planning the operations of the manufacturing departments. In addition there is another advantage in keeping the store's ledger clerk separated from the storeroom in that there is a constant check on the operations of the store's force and that it tends to prevent collusion between the store's ledger clerk and the storeroom force in the careless issuance or fraudulent withdrawals of stock.

Receiving Materials

Whether materials are received by a separate Receiving Department or by the storekeeper generally depends upon the size of the concern. But in a majority of the moderate and larger plants, it will usually be found that a separate Receiving Department is maintained while in the smaller plants, the receiving is done through the storekeeper. Whether one or the other means of receiving is used, the method of procedure is similar. The rule is that no material should be accepted unless there is a purchase order copy to check against, and no material in excess of the purchase order quantity should be taken into stores unless written authority to do so has been given by the Purchasing Department whether or not the storekeeper is charged with the duties of receiving, he should always count, weigh or measure all material before accepting it for stores, because otherwise he may later be held accountable for something he never received.

RECEIVING RECORD No._____

Received From_____ Date_____

Address_____ Purchase Order_____

Quantity	Size	Quality	Description

Received by

Record of Goods Received

How Receiving Department Operates

The receiving clerk receives the materials, determines and reports the quantity received, inspects them as to quality, and delivers them to the storeroom or the department for which they were purchased. Sometimes a separate inspection department is maintained to see that materials purchased comply with definite standards, but this may be regarded as subdivision of the receiving department.

After the material has been compared with the purchase orders and checked, the receiving report is then prepared in triplicate from the duplicate purchase order. It should show the following: name of vendor, address, number, quantity, description, etc. In addition, it may contain such information as; purchase requisition number, number of account to be charged, name of transportation company, whether transportation charges are prepaid or collect, etc., all depending on what information the individual plant wants on their receiving report. Spaces are provided for the signature of the one receiving the goods and often spaces are provided for the signatures of the persons who verified the count, inspected the goods as to quality and received the material from the receiving department.

When the receiving clerk finally delivers the

Requisition for Material _____ Req. No. _____
Charge _____ Date _____

Quantity	Kind of Material	Unit Cost	Cost

Received by _____ Signed _____

Material Requisition, or Order on Storeroom

material to the storeroom it is accompanied by the triplicate receiving report which indicates the quantity and kind of material received. The storekeeper places the materials in their various storage places, the materials being held in stock until such time as they are required by the factory.

Bin Records

Raw material and supplies are arranged in the storerooms in closets, racks or bins. For each bin, there is a bin record which should be placed in a convenient place where the material is stored. This record should provide for information as to the receipt and issuance of the material. Columns may be provided, showing the dates, quantities of receipts, withdrawals, and the balance on hand. These entries should be made daily whenever material is put in, or taken out of, the storerooms and are made by the persons whose duty is to handle and record the movement of the materials from and to the storerooms. Bin records should be as simple as possible.

Record of Raw Material

The record of raw materials (see form) is one of the most important of the forms. This record is also known by the terms "Stock Record," "Stores Ledger Record," "Storeroom Record," and by many other such terms. The stock record shows the material received, the material used, and the balance which should be in the storeroom.

The stores ledger sheets should be so arranged as to present the following information:

In the heading: name of the account; account number; kind of material; maximum and minimum quantities to be carried in stock; unit of measurement; location in the storeroom.

The main body of the record is usually divided into four sections, as follows: an order section, showing the date, purchase requisition number, and quantity of material ordered from the purchasing department, with the date delivery; a received section, showing the date and quantity of material received, with the cost per unit and the total cost of the quantity received; an issued section, showing the date, stores requisition number, and the total cost of the quantity issued; and a balance section, showing the date, quantity and cost of the material on hand. Any other information desired may be shown, varying with each individual plant, but the above are the main essentials.

Material Requisitions

The material or stores requisition is an order upon the storeroom for a specific quantity of materials and supplies needed for use in the manufacturing departments. They are formal orders upon the storerooms, approving and authorizing the issuance of the material called for. They should contain detailed description of the materials desired, together with quantities. Each material requisition should be dated and numbered, and also be signed by the person receiving the material and should bear the approval of some person in authority. The requisition may contain the following data; date; requisition number; number of account to be credited; quantity and kind of material wanted; where to be delivered; unit cost; total cost; production or standing order to be charged; signature of person authorizing the requisition; and signature of person receiving the material.

The procedure of preparing the stores requisition is to make out in duplicate the requisition, both copies of which are sent to the storekeeper, who issued the material and takes a receipt. The receipt is usually taken on the duplicate copy, which is retained by the storekeeper. The original copy goes to the stores ledger clerk who computes the cost of the material and makes the necessary entries on the stores ledger. He then forwards it to the cost department where it is charged either to the material section of the production order or standing order. A separate stores requisition should be made out for each production order or standing order on which material is to be issued. If material for more than one lot is covered by the same requisition, errors are very apt to creep in the posting to the production orders.

Credit for Material Returned to Stock

It often happens that materials are returned for credit to the storeroom because of stock drawn in

BIN CARD

Article _____ No. _____ Units _____

Date	In	Out	Balance on Hand	Date	In	Out	Balance on Hand

Bin Card to Be Placed in Convenient Location

excess of actual requirements. This may also occur when an excessive allowance for spoilage is included on the store's requisition, or when a production order calling for a given quantity of finished product is reduced to a smaller quantity after the material has already been withdrawn from stores. When the excess material is returned to the storeroom, a credit or returned material report is made out in order to correct the previous entries (see form).

The returned material report (or credit slip) may be made out by the storekeeper upon receipt of the material, or by the person duly authorized to do so. It is then sent to the stores ledger clerk who figures the cost of the returned stock and enters it on the stores ledger. It is then forwarded to the cost department where it is entered as a credit to the production order or standing order to which it was originally charged, the entry being made in the material section of the order in red ink.

Sometimes excess material is not sent back to the storeroom but is used on some other order. In such cases, a return or credit report should nevertheless be made out. Otherwise the distribution of material cost on production orders will be incorrect. Some orders will be charged with more while others will not be charged with sufficient cost. Making out return reports will guard against this.

Scrap Report

Every manufacturing plant finds that quite a onsiderable amount of scrap results from operations. Although the value of scrap is much smaller than that of the original material, as long as it has some value, it is worth while recording it on the books. Scrap material should therefore be accounted for in the same way as other materials are.

Scrap material should be gathered in the factory at regular periods and placed in the storeroom until such times as it is sold for junk or otherwise reclaimed. The scrap report (see form) is prepared, showing the amount of scrap material collected and turned over to the storeroom. The scrap report is prepared in the same way as the returned material report.

SPOILED MATERIAL REPORT No.
Returned by Date

Quantity	Kind of Material	Spoilage Value

Disposition of Charges
Dr. Stores Spoiled Material _____ Cr. Production Order No. _____
Material Spoilage _____ Order No. _____

Spoiled Material Report for Crediting Account

Spoiled or Damaged Material Report

A considerable amount of spoilage and damage in materials in every manufacturing plant must be considered and accounted for. The spoiled or damaged materials have some value and that value must therefore be properly recorded. When material is spoiled and cannot be used, it should be returned to the storeroom and the proper charges and credits should be made on the accounts concerned. The return of the damaged material is recorded on the spoiled material report (see form). The spoiled material report is similar to the returned material report and is treated similarly.

The entry for the value of the spoiled material on the production order or standing on which spoilage occurred must credit that order with the original value of the material issued, because the

SCRAP REPORT Date _____ No. _____

Charge Stores Account No.	Quantity	Kind of Scrap	Unit Value	Value

Received by _____ Returned by _____

Report of Scrap. Class, Quantity and Values

cost of the order is reduced to the extent of the complete value of the material when it was spoiled. The difference between the original value and the spoilage value of the material is usually considered an increase of the amount of manufacturing expense and is charged to a standing order for spoiled material.

Stores Ledger Entries

When material is returned, the return material report is the basis for entry on the store ledger for any material previously issued and which has been returned to the storeroom. As returned material is a reduction of the amount of material issued, the best procedure is to make an entry in red in the issued section of the account. In this way, instead of increasing the receipts, the amount of issued material is reduced and is more accurate as a basis of comparing the total receipts with total issues.

Stores Inventory

The stores ledger shows the amount of inventory that should be on hand although this is not necessarily the amount that is actually on hand. Errors usually occur in many ways such as incorrect counting of material as it is issued, etc. To check on the store's ledger and make the necessary corrections, it is essential that a physical inventory of the material actually on hand should be taken.

A great many concerns make it a custom to take physical inventory once a year. Such inventory taking usually involves a great deal of difficulty and expense, even necessitating the shutting down of part or all of the plant during the inventory period. Another bad feature is that it is necessary at such time to use a number of persons to take inventory who are unfamiliar with the inventory and as a result, a lot of inaccuracies take place. Besides, the length of time between inventories permits stealing and prevents errors from being disclosed in time to stop their repetition.

STORES INVENTORY REPORT

NO._____

DATE_____

Kind of Material _____

_____ Stores Account No. _____

Quantity on Hand _____

Unit Cost _____

Total Cost _____

Over Stores Ledger Short of Stores Ledger

_____ Quantity _____

_____ Cost _____

Inventoried by _____ Entry on Stores Ledger By _____ Entry on Standing Order By _____

Stores Inventory Report for Continuous System

The best plan is to maintain a continuous system of physical inventory during the year. When such method of procedure is followed, the entire amount of materials is covered at least twice or three times a year. Errors are eliminated almost entirely because the inventory is taken by stock clerks familiar with the stock. And the result of this system is that at all times the store's ledger inventory (or book inventory) is very nearly in agreement with the actual amounts on hand. Annual inventories are thus eliminated, and errors are found in time to prevent their occurring again.

Stores Inventory Report

Usually when the quantity of a given material approaches the minimum, the store's ledger clerk

STORES LEDGER

Kind of Material _____ Account No. _____

Maximum _____ Minimum _____ Unit of Measurement _____ Location _____

Ordered				Received				Issued				Balance			
Date	Purch. Req. No.	Quantity	Date Wanted	Date	Quantity	Unit Cost	Cost	Date	Stores Req. No.	Unit Cost	Cost	Date	Quantity	Unit Cost	Cost

Stores Ledger Sheet

MATERIAL CREDIT SLIP			DATE	No.
Charge STORES A/C	Quantity	Kind of Material	Unit Cost	Cost
Received by _____		Returned by _____		

Credits for Material Returned

prepares a store's inventory report (see form) calling for a physical inventory of that material and forwards it to the storekeeper. The storekeeper then takes an inventory of the material called for, enters the amount on the inventory report and returns it to the store's ledger clerk.

If the quantity on hand is found to be greater than the balance called for by the store's ledger account, then it is evident that less material has been issued than was called for by the stores requisitions. In that case, the store's ledger account is adjusted by an entry in red in the issued section for the difference between the account balance and the actual amount. On the other hand, if the quantity on hand is less than the balance on the store's ledger account, it shows that more materials have been issued than were called for by the stores requisition. The adjustment is made by an entry for the difference in the issued section of the store's ledger account.

Summarizing the Materials Consumed

Each day the store's ledger clerk sorts the various stores requisitions and reports in the same order as the columns on the summary, listing them under their appropriate headings. When all entries have been made, the columns are totaled and the totals are shown as follows:

Summary of Materials Consumed.
Month of ———

Materials Issued for Production Orders..	———
Less Materials Returned from Production Orders	———
Direct Materials Consumed.....	———
Materials Issued for Standing Orders...	———
Add Inventory Shortages.....	———
Less Inventory Over Amounts.....	———
Indirect Material Consumed	———
Total Material Consumed.....	———

Summary of Scrap and Spoiled Material
Month of ———

Original Cost; Material Spoiled on Production Orders	———
Scrap Value, Material Spoiled on Production Orders	———
Scrap Received from Standing Orders...	———
Scrap Received from Standing Production Orders	———
Scrap and Spoiled Materials Used.....	———

Summary of Routine of Storeroom Operation and Material Recording

1. Receiving materials into the storeroom and holding them in stock.
2. Issuing materials from the storeroom for use in the factory.
3. Keeping a record of the quantity and value of materials, received and issued and of the inventory of materials on hand.
4. Verifying and accuracy of the book inventory by comparison with a physical inventory.

Hoover Pledges Federal Aid Support

A continuation of the Federal Aid program of the United States Government, was pledged September 21, 1928, by presidential nominee Herbert Hoover to a delegation of representatives of the American Road Builders' Association. He declared that while he did not care to be definitely committed to an exact sum for Federal Aid, that he was 100 per cent for Federal Aid in the construction of the highway systems of the United States.

Charles M. Upham, Secretary-Director of the Association, outlined to the presidential nominee the progress made in improvement of the primary highway systems of the country, and the growing needs for aiding the farmer by giving him good roads for the marketing of his product.

"The so-called seven-per-cent system of federal highways, which when completed will comprise a total of 180,000 miles of interstate highways," Mr. Hoover declared, "should be completed before the Federal Government can commit itself to an extended program on the improvement of the secondary, or county system."

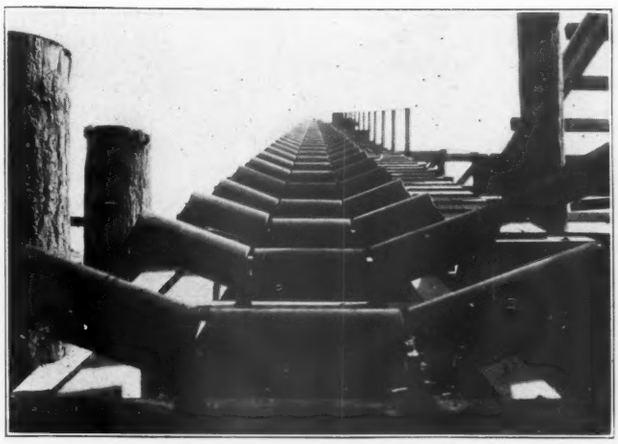
He pointed out that under the authority of the Federal Government only highways that run interstate, and on the Federal Aid System can be improved with the aid of federal funds. He expressed a belief, however, that in many instances where there are but one or two interstate highways now, there should be probably many more and that the Federal Government could enlarge upon its Federal Aid program, when the time comes, and thus in reality actually begin improvement of what are now commonly known as secondary highways.

An appeal, similar to that voiced by the American Road Builders' Association, for an expansion of the Federal Aid program, was voiced also by the National Rural Letter Carriers' Association, representing 44,000 rural mail carriers. Ned H. Goodell, president of the Letter Carriers' Association, told Mr. Hoover that better highway systems along the 1,232,000 miles of R. F. D. routes was the outstanding need of the rural communities. He declared that approximately only 65 per cent of the rural districts of the country are adequately served by rural free delivery, due to the need for good roads.

MATERIAL HANDLING PROBLEM SOLVED BY GLACIER GRAVEL COMPANY

CONSIDERABLE comment on the Pacific Coast has been directed lately to the operations of the Glacier Gravel Company of Gravel Center, Washington. This company operates an efficient sand and gravel plant about forty-five miles southwest of Seattle and about eight miles south of Tacoma on Puget Sound on the main line of the Northern Pacific Railroad from Seattle to Portland. The deposit owned is one of the largest and best in the Northwest. The material has practically no waste and no oversize. The plant is located on salt water and close to a large center of population.

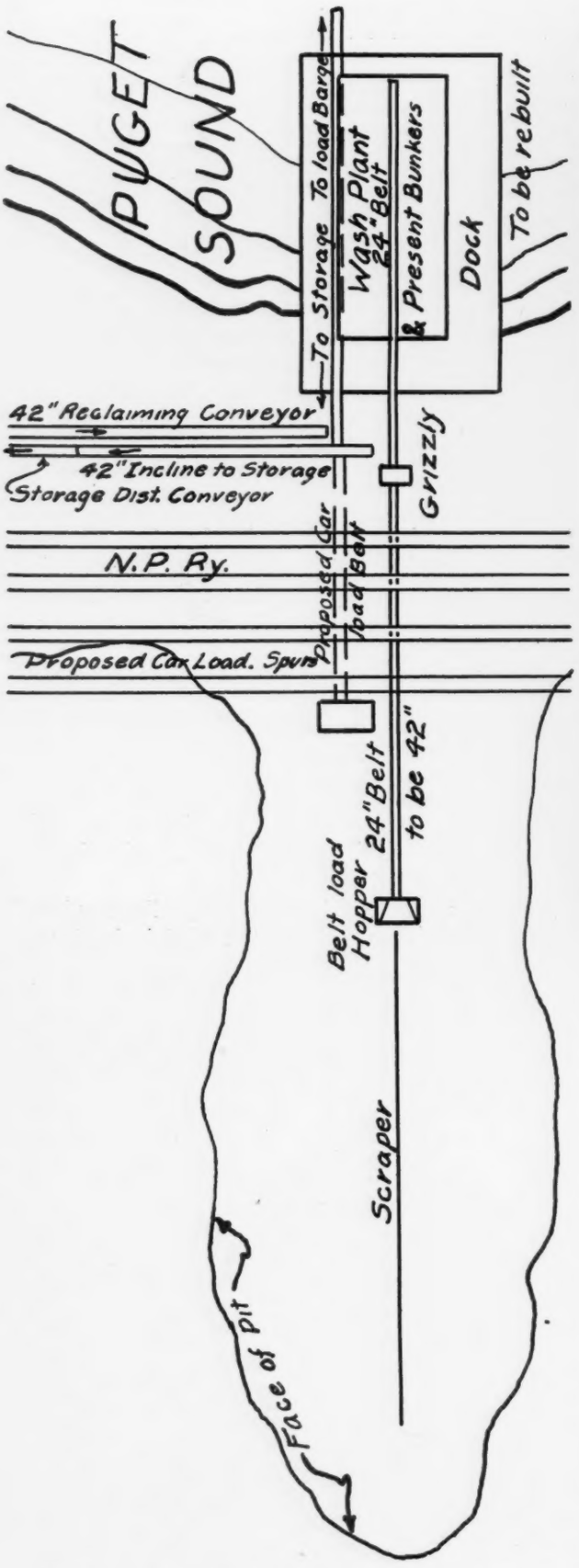
It became necessary the first of this year to increase the plant capacity from 1,000 yards per eight hour day to 6,000 yards and to provide suitable storage facilities in order to operate the plant to better advantage. Belt conveyors were finally selected as the means of accomplishing this. The outstanding factor in the selection of the belt conveyor equipment was the question of corrosion. The use of sea water for washing presented a serious hazard due to the nature of the corrosive action of salt water. The fact is that both corrosion and abrasion were factors. Any ferrous metal will naturally corrode when subjected to salt moisture and when such corrosion forms on belt conveyor idlers it is immediately removed by the friction or abrasion of the belt, again exposing bare metal to the corrosive element. This type of service requires a metal of extremely close grain to prevent corrosion and also a hardened metal to resist the abrasive elements. Rex Stearns Timken chilled face cast iron pulleys were selected as the troughing rollers on the belt conveyors. The one piece pulley shells in these units are cast in a metal chill which results in a white iron face of extreme hardness and at the same time one of exceptionally close grain. The complete installation of the Glacier Gravel Company consists of 2,000 feet of Stearns belt conveyor with the troughing rolls spaced four feet apart and the return rolls twelve feet apart. The belt speed is maintained at 350 feet per minute.



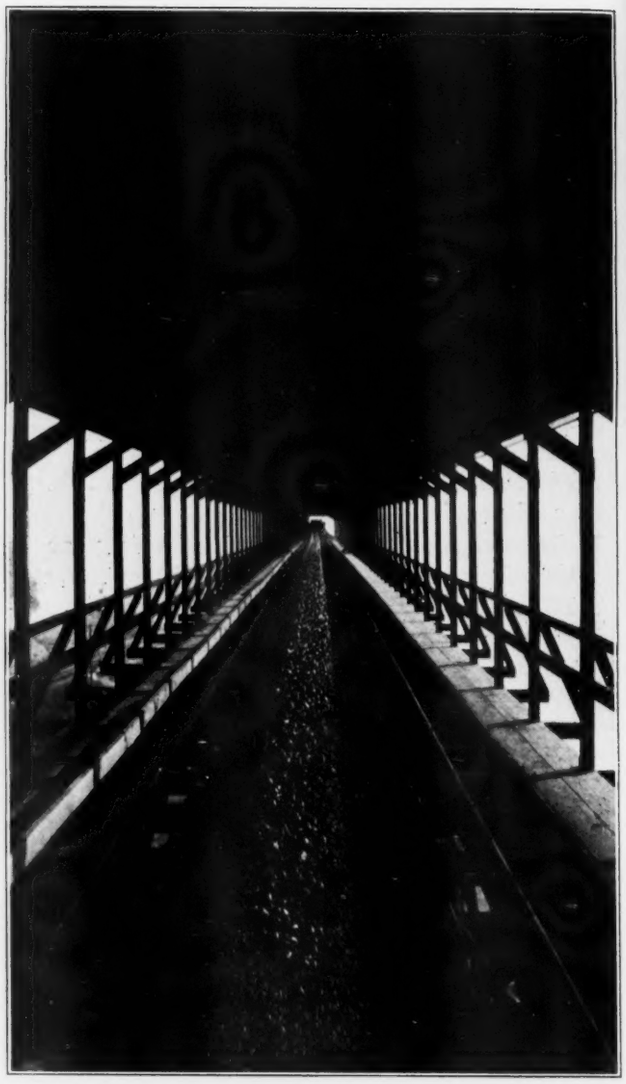
Detail of Idlers on Incline Conveyor

A Bagley scraper digs and drags the sand and gravel to a hopper which feeds a 24 inch Stearns

View Showing Washing Plant and Part of Storage Trestle Under Construction from Side of Pit



The General Layout of Glacier Gravel Company Plant



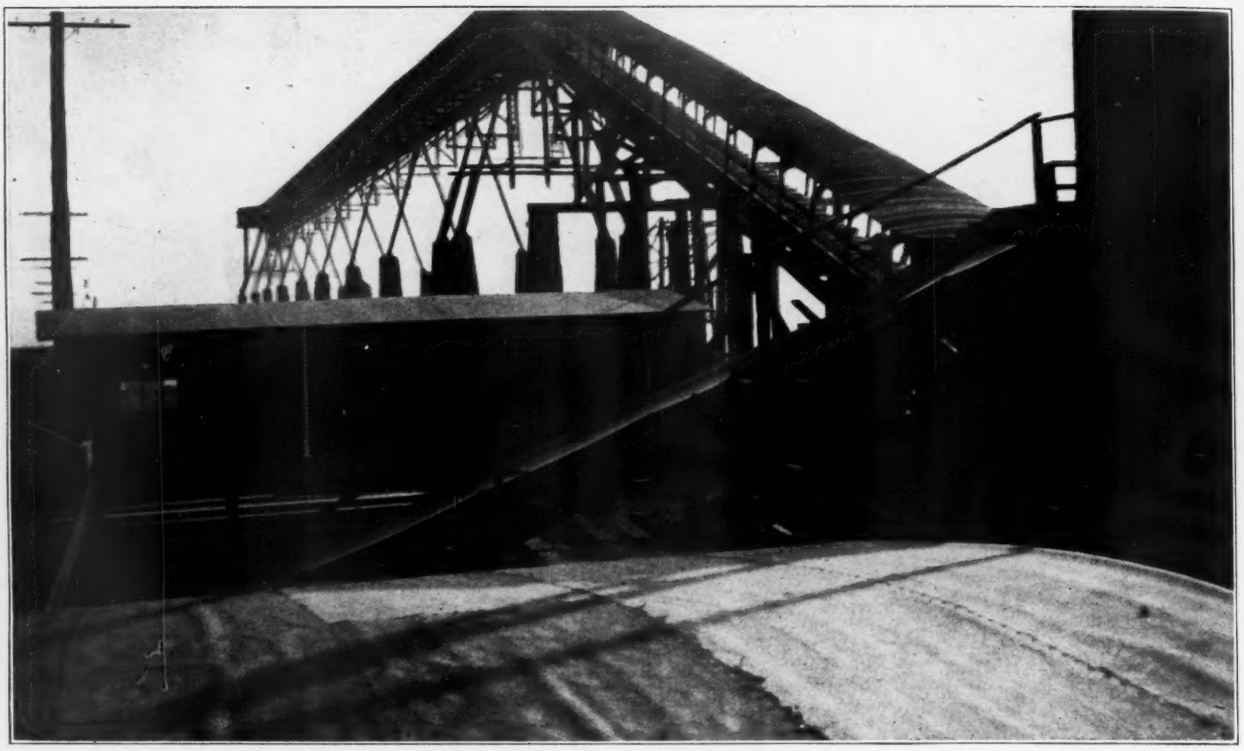
The Main Distributing Belt Partially Loaded

belt conveyor which conveys the material at an angle of 17½ degrees under the railroad tracks to the grizzly. This grizzly discharges on to another 24 inch belt, which runs over the washing plant and discharges into the washing plant. Material from the washing plant was then placed in small bunkers which discharged on to a 36 inch belt, which ran on the dock and loaded into barges. The only storage capacity at that time was in the bunkers, which necessitated at the busy season of running the plant overtime the greater portion of the time and also made it necessary to dump various sizes of material which were not in demand in the bay in order to make room for material for which there was a demand.

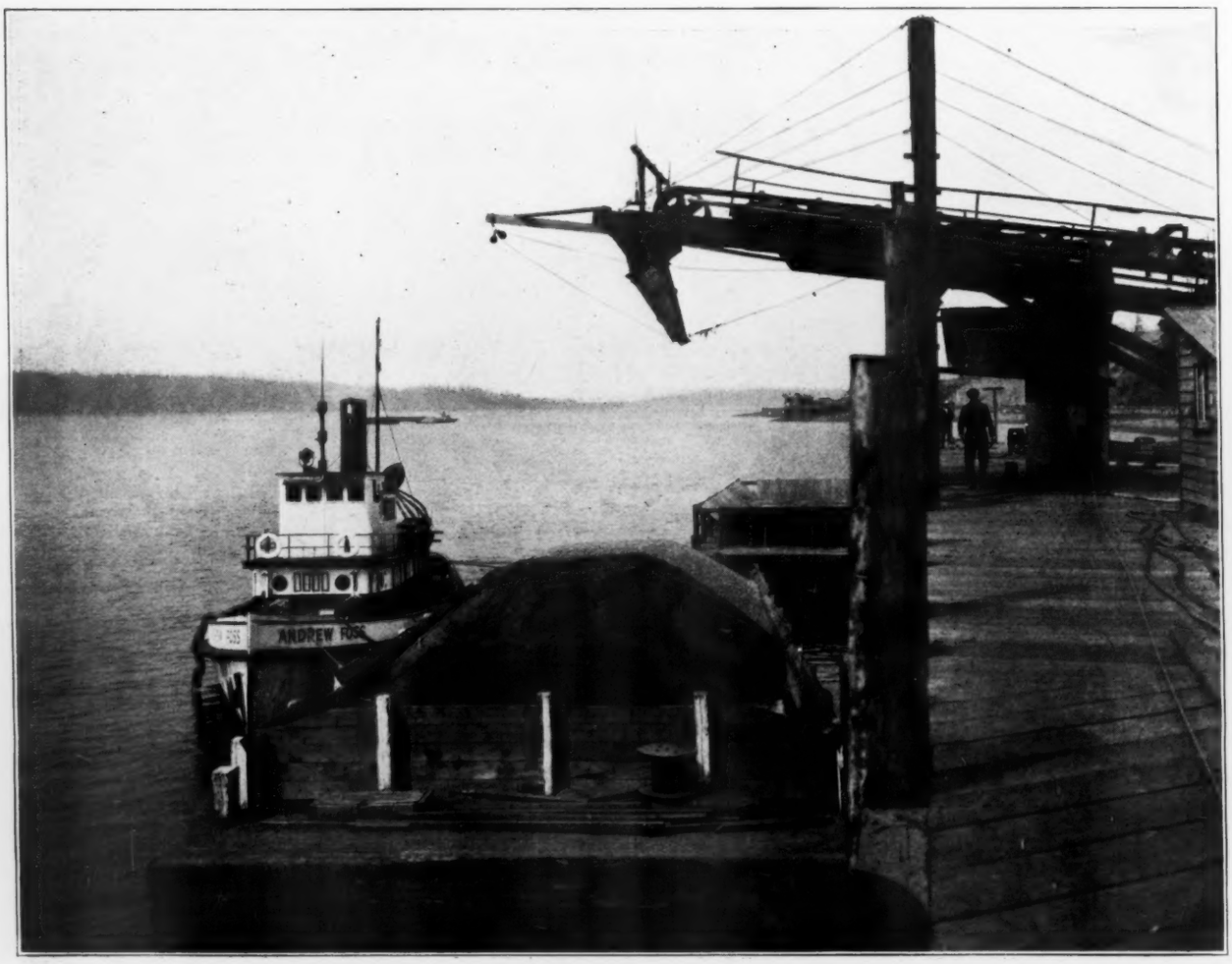
Of course, the first step taken was to correct the waste of material and to have a storage of sufficient capacity, so that the plant could operate normally at all times and be in a position to meet orders as they were received. This necessitated a greater storage capacity and as it was decided to make the capacity of the plant 6,000 yards per

Distributing Trestle with Belt in Place Ready to Operate

Looking Into the Pit from Top of Washing Plant

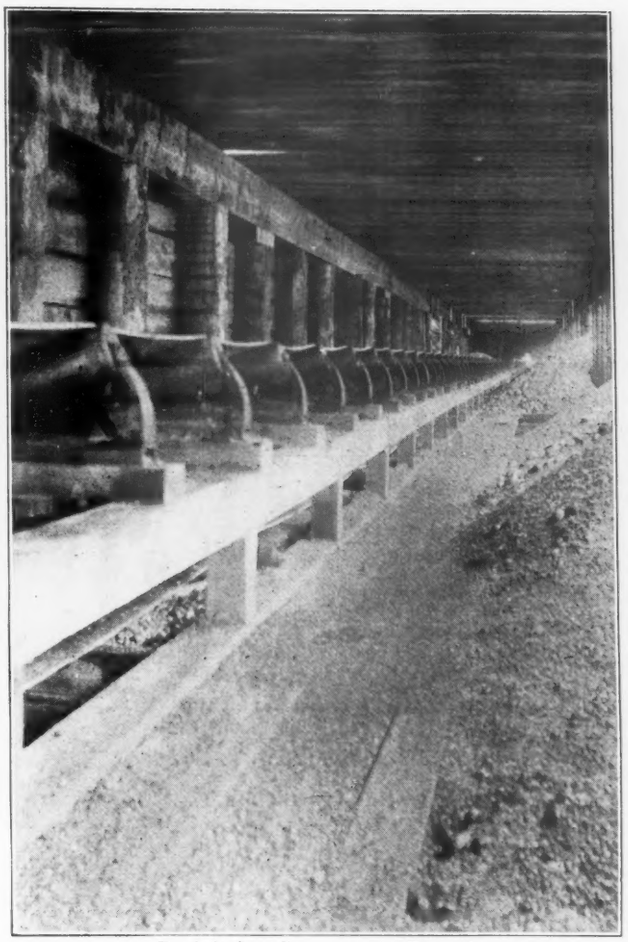


The Completed Distributing Trestle



Showing Method of Loading Barges

day, this was taken into consideration in planning the storage unit. To do this, a 42 inch belt conveyor system was installed over and under the storage pile. This system includes one 42 inch belt conveyor, 250 feet long, running from a level underneath the hoppers under the washing plant to a point 70 feet above. This belt in turn discharges onto a 42 inch belt—500 foot centers, having a self-propelled automatic tripper. Underneath the storage pile a 42 inch—700 foot centers is used having gates at about ten feet intervals, which will carry the material back to a point underneath the hoppers and discharge onto a belt which will load barges. These three belts together with storage system are the only units of the proposed permanent plant, which are now installed. All of the equipment is the latest in the market. The troughing rollers which carry the belt are Rex Stearns—three unit—chilled face Cast Iron Rollers with Timken Roller Bearings as manufactured by the Stearns Conveyor Company of Cleveland, Ohio. The return rolls used are one-pulley, heavy tubular steel rolls with Hyatt Roller Bearings as manufactured by the Stearns Conveyor Company of Cleveland. All drives on the belts are through motors direct connected to enclosed Gear Reducers which are direct connected to the Drive Shafts. The motors are wired for remote control and the belt running up the incline has a solenoid brake to prevent running away in case power should go off.



Reclaiming Conveyor in Tunnel

The Distributing Trestle Erected with Most of the Belt Idlers in Place

Material is now handled from underneath of bunkers to the storage belt by a 36 inch belt. This belt is reversible and will also carry material directly from underneath the bunkers to barges. It is planned to change this belt over to a 42 inch belt together with all the other belts and also to tear down the present washing plant and build a new modern and enlarged plant, which will take care of the full capacity of the 42 inch conveyors.

At present no arrangements have been made to load cars. The future expansion plans call for several car tracks and the conveyor belt running to these tracks from the storage pile. With the completion of all the work now planned, it will be possible to load a train of cars in approximtely one-half hour and also load barges at the rate of 6,000 yards per day. Plans for the design of the plant were made by Mr. Robert Heffernan, president, and Mr. C. R. Marquardt, manager, of the Glacier Gravel Company.

Surplus Military Explosives Used

More than 126,000,000 pounds of TNT and other surplus military explosives accumulated by the Government at the close of the World War have been used for industrial purposes, states Dr. Charles E. Munroe, Chief of the Explosives Division, United States Bureau of Mines, Department of Commerce. These explosives have been expended in road building, in construction of dams and reservoirs, in draining swamps, in clearing cut-over lands and for other useful purposes which have added materially to the wealth of the Nation.

After the entrance of the United States into the World War, the Nation set about the production of military explosives on a scale never before undertaken, and this work continued with such acceleration that when the Armistice was declared the country was producing military explosives in quantities never before realized. There is little doubt, Dr. Munroe points out, that this developed capacity was a material factor in ending the war. A consequence, however, was the accumulation at various points in this country of enormous stocks of high explosives and propellents, whose safeguarding during storage and transportation constituted a serious and costly obligation, while entailing a menace to the communities near which the material was stored.

The Bureau of Mines, which had taken an active part in the technical research necessary to the production of military explosives on a tremendous scale, advocated the use of these great stocks of surplus explosives on governmental and industrial peace-time projects, pointing out the heavy expense that would be entailed for either the continued preservation or the destruction of these explosives. This suggestion met with much adverse criticism, great stress being laid on the fact that military explosives, and particularly TNT, never had been used industrially and were, therefore, unfit for such purposes. The Bureau, however, proceeded to demonstrate the suitability of these explosives for industrial purposes and issued several publications setting forth the results it had obtained in practice in the field and giving detailed instructions as to the best methods of use. The result was that this huge store of military explosives, instead of being a total loss or constituting a menace to public safety, was diverted into useful peace-time purposes.

Recently the Bureau was informed that some 250 tons of this military TNT, stored for use near an important Federal project, had deteriorated into a dangerous condition and should be destroyed. An explosives expert was detailed to inspect this supply. When tested, both at the Bureau of Mines Experiment Station at Pittsburgh and at Picatinny Arsenal, this suspected TNT was found to conform completely with the specifications under which it was originally purchased and to be in a perfectly stable condition. This TNT had been packed loose in wooden boxes and with time some of these boxes had become warped and broken, making it necessary to repack such material if it is to be offered as freight.

The results of the inspection and testing of the samples showed that the TNT was in first-class condition and entirely suitable for use as a blasting agent. It is gratifying, concludes Dr. Munroe, to find that TNT, which has disclosed such admirable qualities for use in blasting, is proven, from this test of storage for upwards of ten years, to have excellent keeping qualities also.

Employers and Employees Cooperate In Group Insurance

A group insurance program is being carried out by employees of the Patch-Wegner Company, Inc., of Rutland, Vermont, manufacturers of stone working machinery, and of the company's plant in Glen Falls, New York, which is known as the Glen Falls Machine Works. This insurance is being underwritten by the Metropolitan Life Insurance Company on a cooperative basis, employer and employees sharing the cost, and provides them with approximately $280,000 of life insurance, in addition to sick and non-occupational accident benefits.

The employees are divided into two main classes for insurance purposes. Each member of one class, composed entirely of apprentices, on subscribing to the plan receives $1,000 life insurance and in case of sickness or non-occupational injury receives weekly benefits of $10.00 for a maximum of 13 weeks. All other subscribing employees receive $1,500 life insurance and accident benefits of $15.00 a week.

BUILDING AN INSTITUTION IN THE CRUSHED STONE INDUSTRY

By W. E. Trauffer

THE Dolese and Shepard Company, with offices at 111 West Washington Street, Chicago, operates a crushed stone plant near McCook, Illinois, which while not the largest nor the most modern in the field, is a splendid example of what efficient design can effect in the way of permanence. Although now almost 20 years old no important changes have been made in either the design or equipment of this plant and it still retains an enviable position as one of the outstanding plants in this part of the country.

The Dolese and Shepard Company was organized in 1897, succeeding the partnership of Dolese and Shepard which was formed in 1868, and at the time the present McCook property was acquired, operated a plant at Naperville, Illinois, another at McCook, about two miles east of the present plant, and a granite quarry in Neshkoro, Wisconsin.

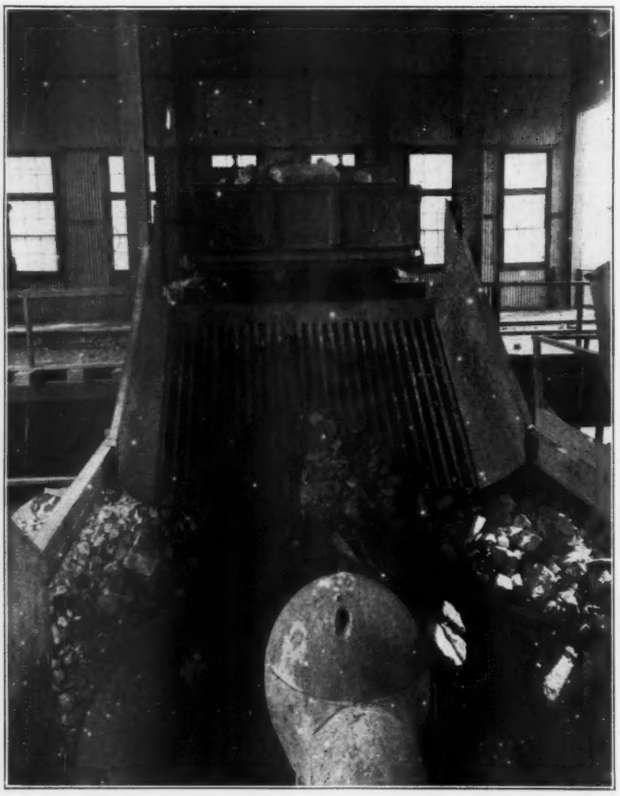
J. F. Talbot, president of the company, has held that position since 1910 when he resigned his position as president of the Dennison Manufacturing Company.

Col. O. P. Chamberlain, vice-president and general manager of the Dolese and Shepard Company, has had a continuous connection with that company since March, 1904, except for two years during the World War. He was elected to his present position in 1911 and has acted in that capacity ever since. During the war he served successively as Major of Engineers, afterwards Lieutenant Colonel and Colonel in the Construction Division of the Army, and is now a Colonel in the Reserve Corps of the United States Army.

Col. O. P. Chamberlain, Vice President and General Manager

Operation of the present quarry was begun about 1870 by the firm of Kimball and Cobb as a hand quarry for the production of rubble stone.

View of Plant Showing Part of West End of Quarry



Car Ready to Be Dumped into Primary Crusher

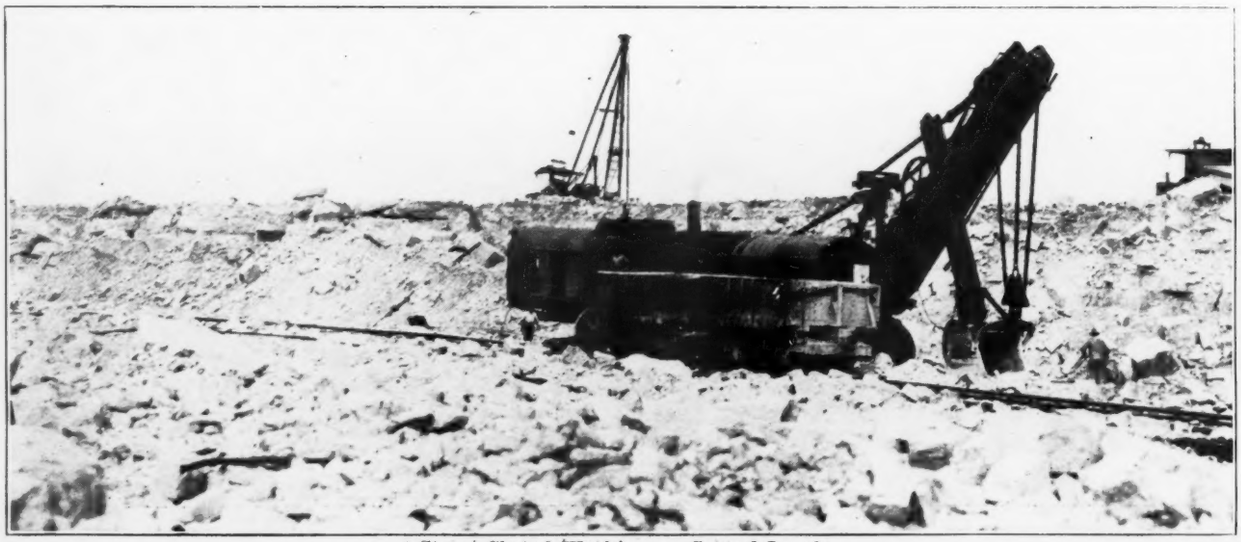
After a time a number 4 gyratory crusher was installed and later on two number 4 crushers were added. After 37 years of operation this quarry was taken over by the Brownell Improvement Company who operated it for a short time and in 1902 sold it to the present owners, the Dolese and Shepard Company. The plant, known as the Gary plant, was operated as an auxiliary to the Hawthorne and McCook plants and produced only a few carloads of stone per day. This plant continued in operation until 1905 when a new plant with a number 9 gyratory crusher and two number 6 and two number 4 secondary crushers was erected with a capacity of approximately 150 tons per hour. After only a few months' operation this plant was destroyed by fire. Steam shovels had by this time entirely supplemented the old hand methods of quarrying.

Plans for the construction of a new plant of sufficient capacity to replace the other two quarries were begun immediately after the fire. The J. C. Buckbee Company, engineers, of Chicago, designed and built this plant which began operations in the summer of 1909 with a capacity of 400 tons of crushed stone per hour. Operation since that time has been continuous and the plant and equipment unchanged except for minor alterations, additions or replacements.

The buildings of this new plant are of concrete and structural steel construction and the siding is corrugated metal, the entire design being as nearly fireproof and permanent as it could possibly be made. The layout is such that the material from the time it enters the primary crusher house flows in a direct line toward the bins and stock pile.

The stone quarried at this plant is a dolomitic limestone composed of approximately 55 percent calcium carbonate and 45 percent magnesium carbonate, with a small percentage of silica, phosphorus and iron. The entire 450 acres of land owned by the company is underlaid by the same kind of stone. Two levels are now being worked and a third one has been started although it is not being worked at the present time. Stone from the upper level is used mostly as flux for steel mills, while that from the lower levels is used for various commercial purposes. The upper level is about 2½ miles in circumference at the present time and varies from ⅝ to ⅞ miles in diameter.

The overburden consists to a great extent of glacial drift, part of it being a granite gravel and including large granite boulders, some of which weigh from fifteen to twenty tons. The line of this glacier can be traced from Hawthorne, some eight miles northeast of the quarry, through the



Steam Shovel Working on Second Level

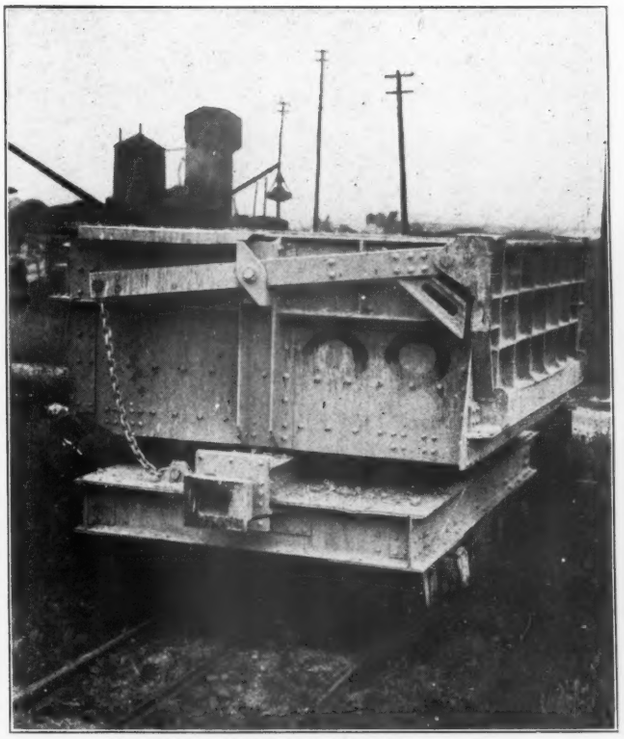
La Grange and McCook quarry districts, and past the Dolese and Shepard quarry to the terminal moraine which is in what is known as the Sag some three miles southwest of the quarry.

Stripping of this overburden, which varies in depth from 4 to 16 feet with an average of about 12 feet, is done by a Bucyrus number 24, 3½ yard dragline. A Bucyrus 50 B, 1 yard shovel, which is convertible into a dragline or crane, is sometimes used for stripping, although mainly used for handling stockpiles. When conditions permit the dirt is hauled away to another part of the property and dumped, but most of the time it is piled to one side as the circuit of the quarry is made.

Drilling of blast holes is done by seven electrically driven Sanderson Cyclone well drills with 5⅝ inch bits. One Sullivan 2 inch and six Ingersoll-Rand 1¼ inch pneumatic drills are also used for breaking up large blocks of stone and drilling for bottom shots. Compressed air for these drills is furnished by a Chicago pneumatic 12 by 10 air compressor which is driven by a General Electric motor. The air line to this pump is connected to a line leading from the compressors in the power house so that in case of a breakdown or other mishap a complete shut-down of the pneumatic drills would not be necessary.

Trojan dynamite, both 40 and 60 percent, is generally used for blasting, although gelatin is sometimes used. Liquid oxygen has also been used with satisfactory results, the largest blast by this method to date requiring 14 holes. Large blasts are seldom made, due in part to the proximity of the quarry to a residential section. The average blast requires about 40 cases of dynamite.

Handling of the quarried stone is done by a 4 yard Osgood Model 120, two Bucyrus 4 yard Model 110, and three Bucyrus 3½ yard Model 95 steam shovels. All of these shovels have traction

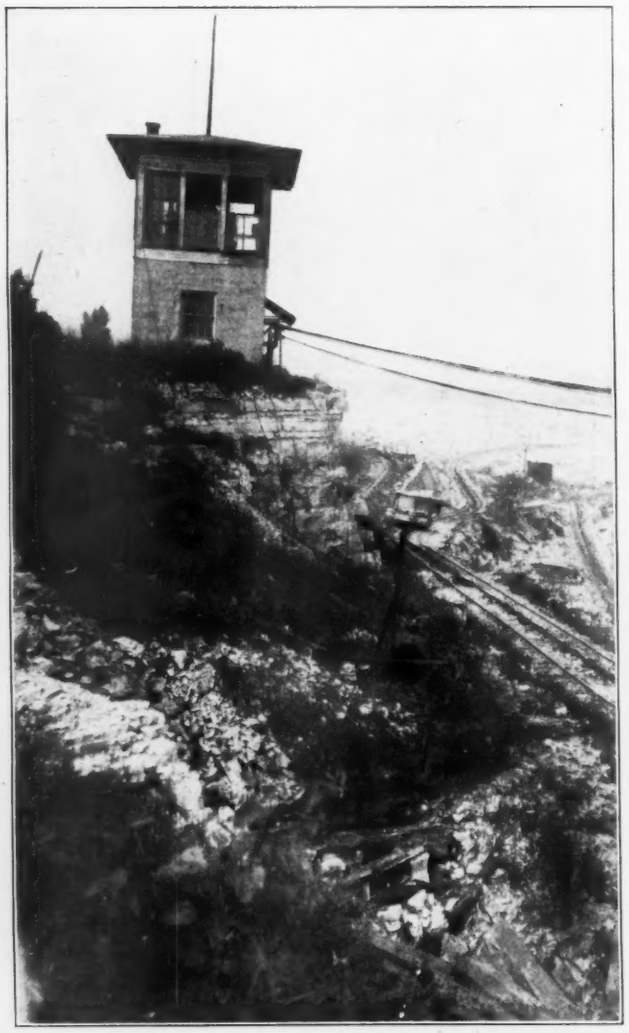


One of the New All Steel Quarry Cars

wheel mountings and some of them have been in operation since 1909. Three of these shovels are working on the upper level loading flux stone and the other three on the lower level loading commercial stone.

All hauling of the stone from the quarry is done by the Woodford system of electric haulage which was installed in 1909 when the new plant was built. This installation is operated under two-man control, an operator in a control tower at the south edge of the quarry controlling all movements of the cars in the quarry and to and from the primary crusher house, and the other man in the crusher house spotting them to be dumped into the crusher. Electric power at 440 volts is

View of the East End of Quarry



Control Tower for Electric Haulage System

furnished by a third rail from generators in the power house.

Twenty-two cars are now being used, 17 of which have frames made by the Cullen-Friestedt Company and the Kettler-Elliott Company. These cars have wooden bodies made at the plant and are driven by two 30 h.p. Allis Chalmers electric motors and drives. The other five cars were built just recently and have all-steel bodies made by Cullen-Friestedt. Two 50 h.p. Allis Chalmers motors are used in these cars. Both the old and new cars have a capacity of 11 cubic yards. Five more new cars are to be added in the near future, motors for these now being on hand in the power house.

The Woodford system will start, stop, or reverse any car at any point on the system. In addition to this each car is equipped with a reversing and stop switch and a power cutout which may be used in case of an emergency. Approximately 8 miles of third rail and standard gauge track are now in use in the quarry and other parts of the property. These cars are also used to haul coal, dynamite and supplies for the shovels and other machinery in the quarry.

The loaded cars, upon reaching the top of the incline to the crusher house, are taken over by the control station in the building which spots them to be dumped into the primary crusher. A counterbalanced hoisting mechanism, built at the plant from an old quarry car motor and a few cables and pulleys, dumps the stone into an Allis Chalmers number 18 gyratory crusher which is driven by a 250 h.p. 440 volt induction motor through a Texrope drive. A starter and controller operate this motor. The stone hook for dislodging large stones is run by an Emerson Brantingham one drum air hoist. An overhead 30 h.p. electric hoist is used to handle repair parts for the crusher and as an emergency stone hook. The control system runs the cars after they are dumped

Dragline Used for Stripping

through the building to the top of the incline leading back to the quarry where they are again taken over by the main control tower.

The primary crusher discharges out of both sides onto two pan conveyors which carry the crushed stone to the top of the number 9 crusher house. The buckets are 54 inches wide with a 24 inch pitch and operate at a slope of 45 degrees on 145 foot centers. The conveyors are each belt and spur gear driven by a 75 h.p. induction motor. The buckets dump into a steel hopper which discharges into two Allis Chalmers number 9 crushers, each belt driven by a General Electric 100 h.p. induction motor. This hopper is so arranged that when the plant is running at capacity the stone is divided equally between the two secondary crushers and during slack periods either of these crushers can be shut off.

A 24 inch Victor Balata steel clip belt on 45 foot centers driven by a 10 h.p. motor, carries the crushed stone from one of the crushers to a hopper into which the other crusher discharges direct. This hopper discharges the stone into two 48 inch by 24 foot Allis Chalmers perforated scalping screens which are chain and spur gear driven by a 50 h.p. induction motor. One of these screens has three sections with 1⅝ inch and three sections with 4 inch perforations while the other has three 2½ inch and three 4 inch sections.

The oversize from the scalping screens goes into a 48 inch by 24 inch bucket conveyor with 113 foot centers which elevates it to the top of the screen house. The screenings go to two 24 inch rubber belt conveyors operating on 140 foot centers which convey them to the bottom of the screen house. These conveyors are each belt driven by a 10 h.p. motor. The bucket conveyor is belt and spur gear driven by a 50 h.p. induction motor and dumps the oversize stone into 4 bins, two of which are used as flux for steel mills and the other two either used for flux or crushed for commercial use. Two tracks under the bins provide facilities for loading into either freight cars or trucks.

Spouts on the north sides of two of the bins discharge into two number 6 Allis Chalmers crushers each driven by a 50 h.p. motor. Both of these crushers discharge onto the same belt conveyor as the screenings from the scalping screens. A similar arrangement of two Allis Chalmers 6 crushers is in place in the south end of the building so that in case of necessity the flux stone can also be crushed for commercial use.

The two belt conveyors from the scalping screens terminate at the two reserve crushers and discharge the throughs from the screens, and the stone crushed in the number 6 crushers onto two 24 inch United States rubber belt conveyors which carry the material at a slope of 20 degrees to the top of the bin house. These belts operate on 330 foot centers and are both spur gear and belt

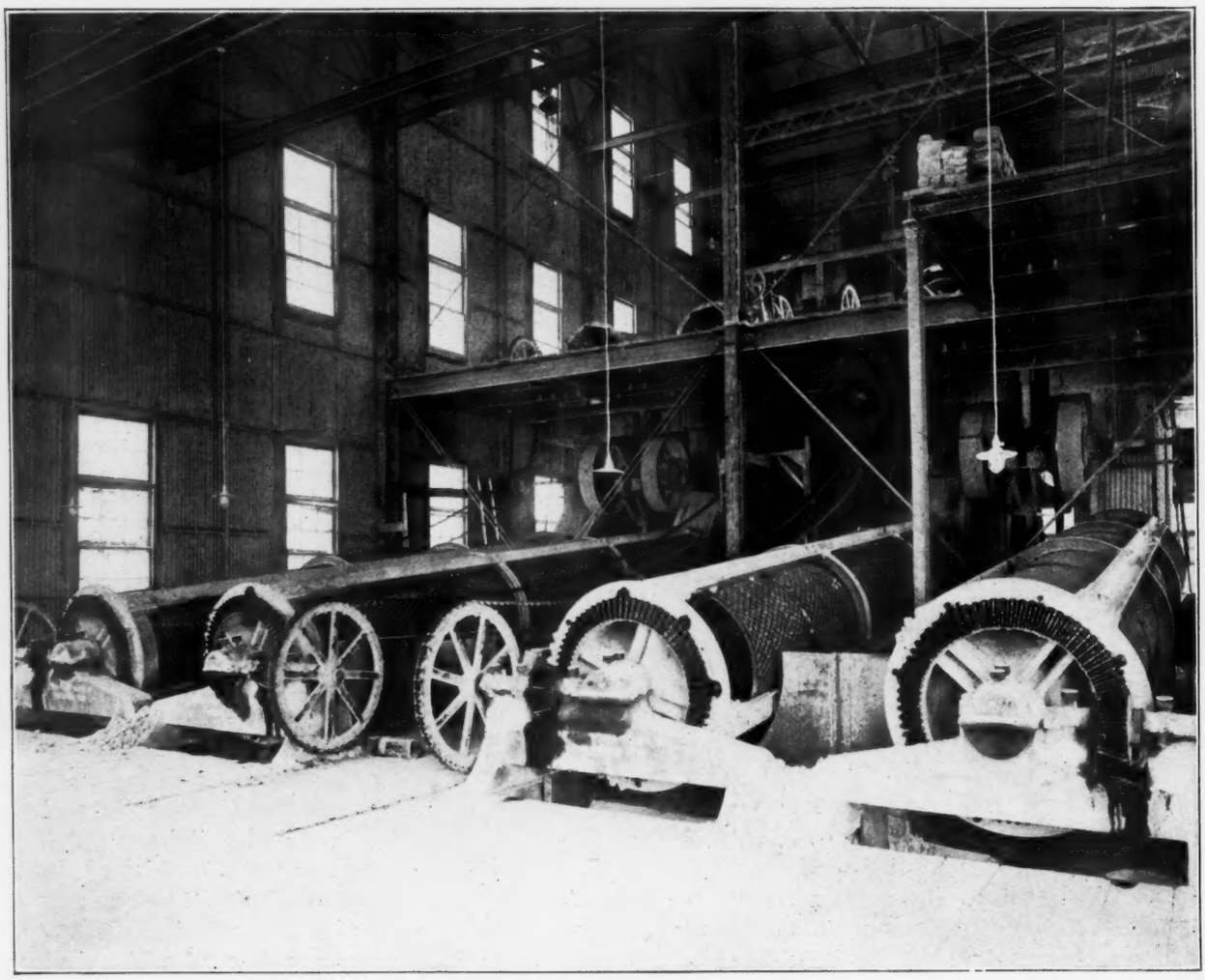
Stockpile and Loader. Conveyor Housing at Left

driven by 60 h.p. induction motors. These belts are each enclosed in a corrugated metal housing on structural steel framework and discharge into two sets of two Allis Chalmers 48 inch by 28 foot revolving screens, one set having perforated and the other Rolman manganese wire sections. The first four sections in each of the four screens are 1⅛ inch while the last three sections in the perforated screens are 1¼ inch and in the wire 1⅝ inch. Each set of two screens is chain and miter gear driven by a 60 h.p. induction motor which also drives two revolving and two shaker screens on the floor below.

Each of the two sets of shaker screens consists of 1 Allis Chalmers one level screen with 1/3 inch and 4/10 inch holes, eccentric driven, and 1 two level Allis Chalmers opposite eccentric screen with ¾ inch holes in the top and 1/3 and ½ inch holes in the bottom levels. The last three sections of the four screens on the floor above discharge into two Traylor vibrating screens with 4/10 inch holes.

The oversize from the first 4 screens goes to two sets of two Allis Chalmers 48 inch by 24 foot perforated rotary screens two of which have 2 sections with 1¼ inch and 4 sections with 2¼

View of Plant with Quarry in Background and Bins in Right Foreground



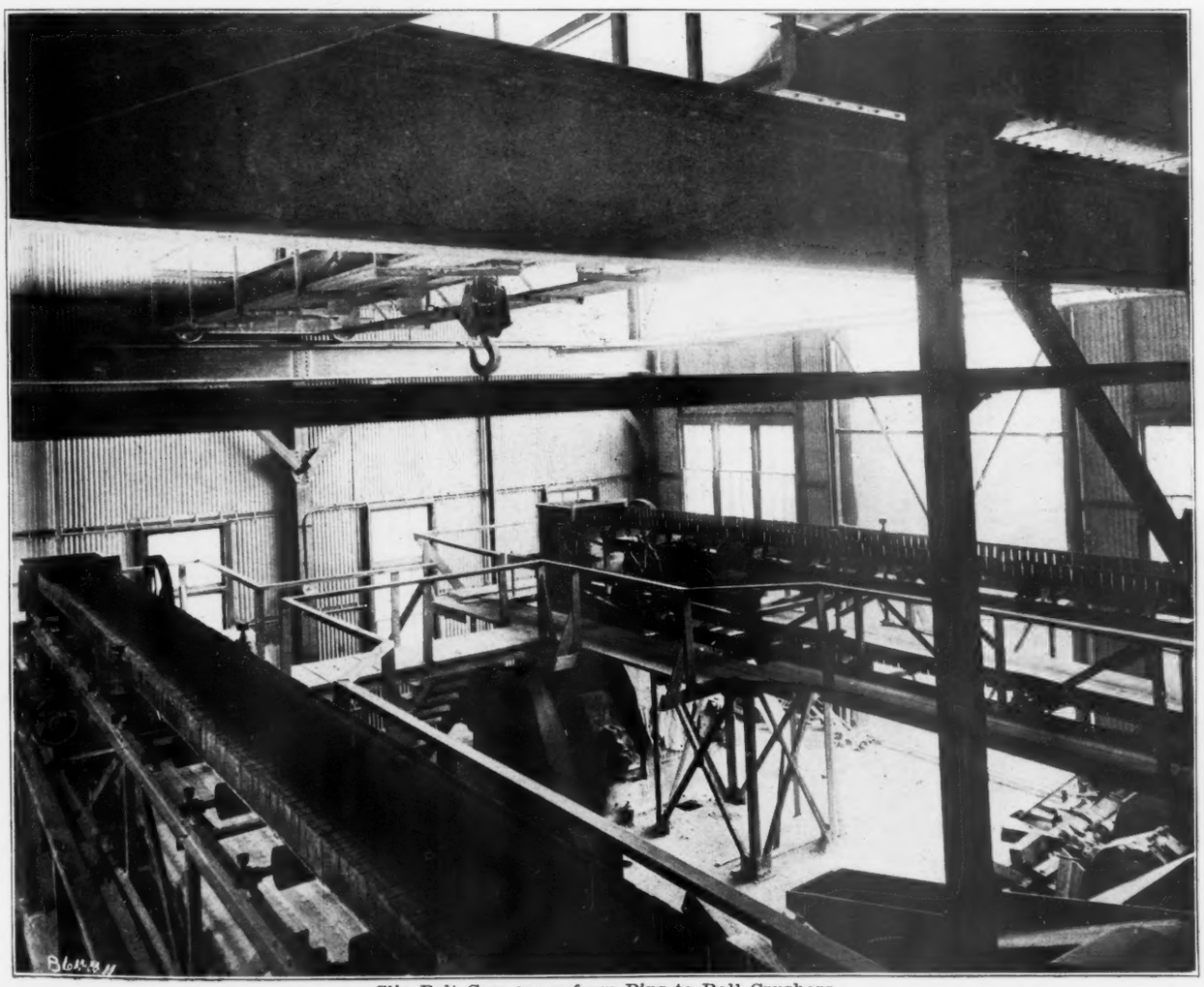
Interior of Screen House Showing Two Floors of Rotary Screens

inch holes and the other two having 2 sections with 1⅝ inch and 4 sections with 2¼ inch perforations. These screens are belt and chain driven by the same motor as the screens on the floor above.

Below the two floors of screens in this building are ten large bins in two rows of five which are each 20 feet in diameter and 32 feet deep. Between these are 12 smaller bins filling up the spaces between and outside of the larger bins. Five loading tracks running under these bins allow the stone to be discharged into cars or motor trucks. The first two bins in the direction of flow receive the 1½ inch oversize material from the shaker screens. The second two get the screenings from the vibrators and the fines from the two one level shakers. Of the third pair of bins the one on the east side gets 1¼ inch and the one on the west 1⅝ inch material from the rotary screens. The fourth pair receives the 2¼ inch material and the last pair the 2¼ to 4 inch stone which are both used for road work. Only two of the smaller bins are now in use, these being the west and center ones of the first row. They are used for ¼ inch material. The first two sets of large bins which receive the finer material are unlined concrete inside. The second two sets are lined with granite blocks and the fifth set with hard brick.

The chutes from the bins are so arranged that when any of the bins containing large stone are full or when there is an unusual demand for the smaller sizes the stone can be discharged from the bins onto two 24 inch Victor Balata clip belt conveyors with 135 foot centers and conveyed back against the flow into a small building adjoining the bin house. In this building two 54 by 24 Allis Chalmers rolls, one with corrugated and the other with smooth rolls, crush the material into fines. Each of these rolls is belt driven by a 100 h.p. induction motor, a Jones clutch being used to take the load gradually. These motors also drive the steel belts from the bin. Two 24 inch rubber belt conveyors take the stone from the rolls to two 24 inch inclined rubber belt conveyors with 154 foot centers which return the stone to a point about half way up the long belts leading to the top of the screen building. These return belts are each driven at the head pulley by individual electric motors and in turn drive the two small belts from the rolls by chain from the tail pulleys. The stone is then returned to the top of the bin house and again passes through the screens.

Here either of two things may be done. If the bins containing the fine material are not full this stone may be diverted to them and if full the four



Clip Belt Conveyors from Bins to Roll Crushers

shaker screens discharge onto a rubber belt conveyor running to a stock pile south of the plant where the material is stored as agricultural limestone. Two Barber-Greene stock pile loaders at the top of the stock piles take the material from the conveyor and distribute it so that the greatest possible amount may be stored. The conveyor housing is of the same structural steel and corrugated roof and siding construction as the other conveyor housings but is supported at the far end by a framework of 12 by 12 timbers. This type of construction was made necessary by the stresses due to the shifting and settling of the stock pile.

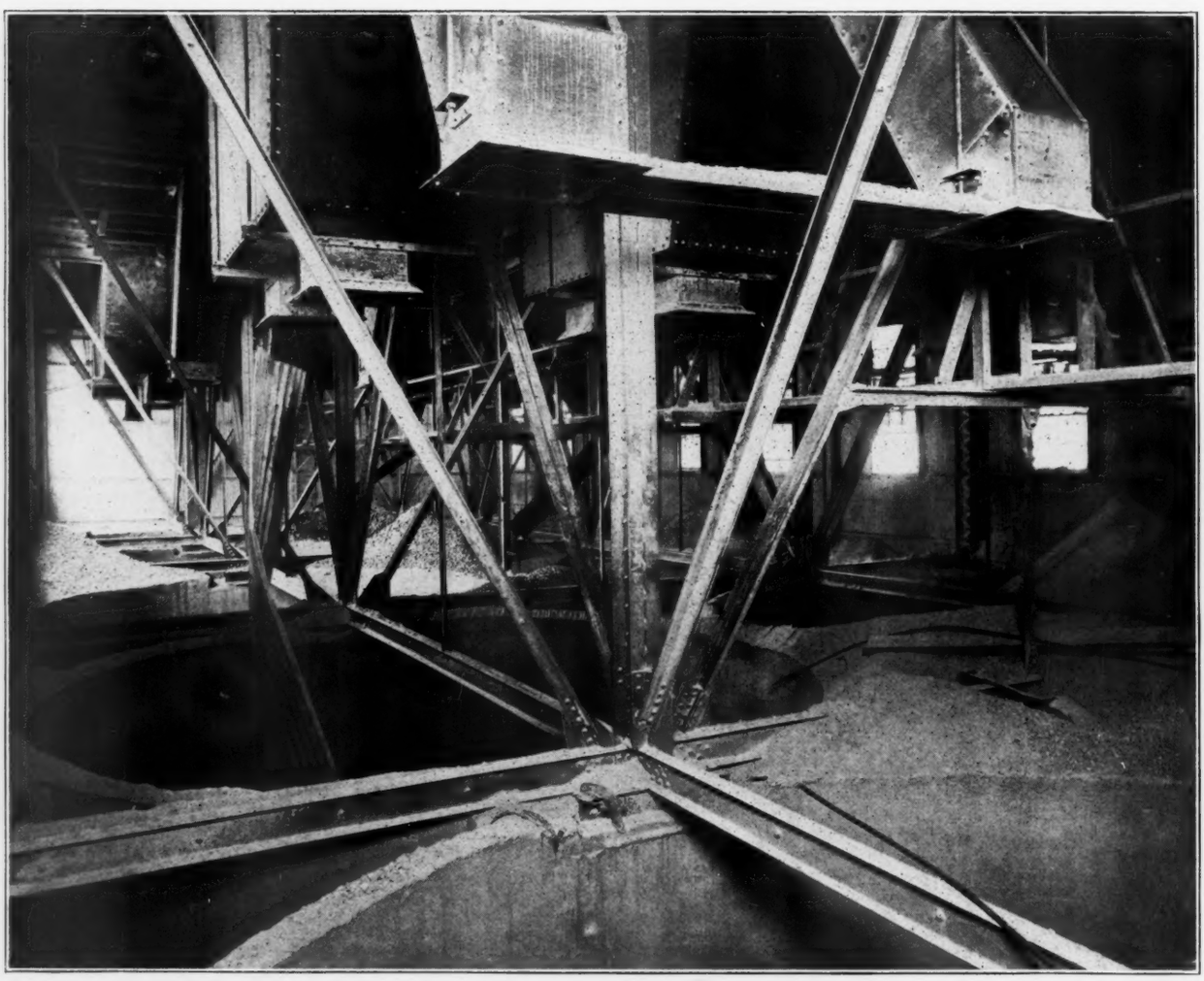
Material of other sizes than agricultural limestone is stored in stock piles near the plant. Handling of this material is done by two Bay City Industrial locomotive cranes with 1½ yard buckets, one of them having a 50 foot boom and the other a 40. All of the switching on the property is done by two Baldwin locomotives of 60 and 32 tons respectively. About 15 miles of switch and storage tracks have been laid on the property.

About 25 per cent of the stone produced varies from 4 to 8 inches in size and is used for lining the open hearth furnaces of some of the larger steel mills. Smaller sizes are used by many wrought steel and foundry corporations as flux stone.

The remaining 75 per cent of the output is commercial stone in the following sizes. FF screenings, passing through a 1/10 inch ring are sold mostly for agricultural purposes; ¼ inch stone is used for roofing and asphalt carpet coating of roads and roofs; sizes from ¼ to 1 inch are sold for concrete; 1 to 1⅜ inch stone is classed as Fine Medium; 1½ to 2¼ inches as Medium; and 2¼ to 3½ and 2¼ to 4 inch as Macadam. The production of agricultural limestone in particular has increased greatly in recent years due to the growing demand from the farmers.

The policy of the management in operating the plant has always been to confine the sizing of the stone to as few sizes as were necessary to meet the commercial demand. The flexibility of the plant design also is such that the production of each size can be varied when necessary to meet the fluctuating demands of the market.

Most of the material produced is shipped out over a branch of the Illinois Central Railroad, formerly the Chicago and Illinois Western Railroad, which skirts the property. It is then delivered by the I. C. to the Indiana Harbor Belt Line



Inside of Bin House Showing Spaces Between Bins and Outer Walls Which Can Be Used as Emergency Bins

and other railroads for distribution in the Chicago district.

The distribution of commercial stone, however, has changed considerably in the last four years. On account of the increase of business within a radius of 15 miles of the quarry, due largely to street and road as well as building construction, many of the districts which were formerly reached only by railroads are now being served by trucks hauling direct from the quarry. Four years ago the amount of material hauled direct from the quarry amounted to only about 4 per cent of the plant output, while last year the truck deliveries exceeded 10 per cent, and are this year expected to run about 16 per cent of the total distribution.

The power house is located just south of the car repair shop and is of concrete block construction. William Schwass, chief electrician of the plant and quarry, including the Woodford haulage system, has his office there. Eleven men are employed in this department to repair and maintain the electrical equipment, some in the power house repairing motors, winding armatures, etc., some operating the control towers for the haulage system and the remainder as trouble shooters and track walkers. All of the electric motor repairing is done here.

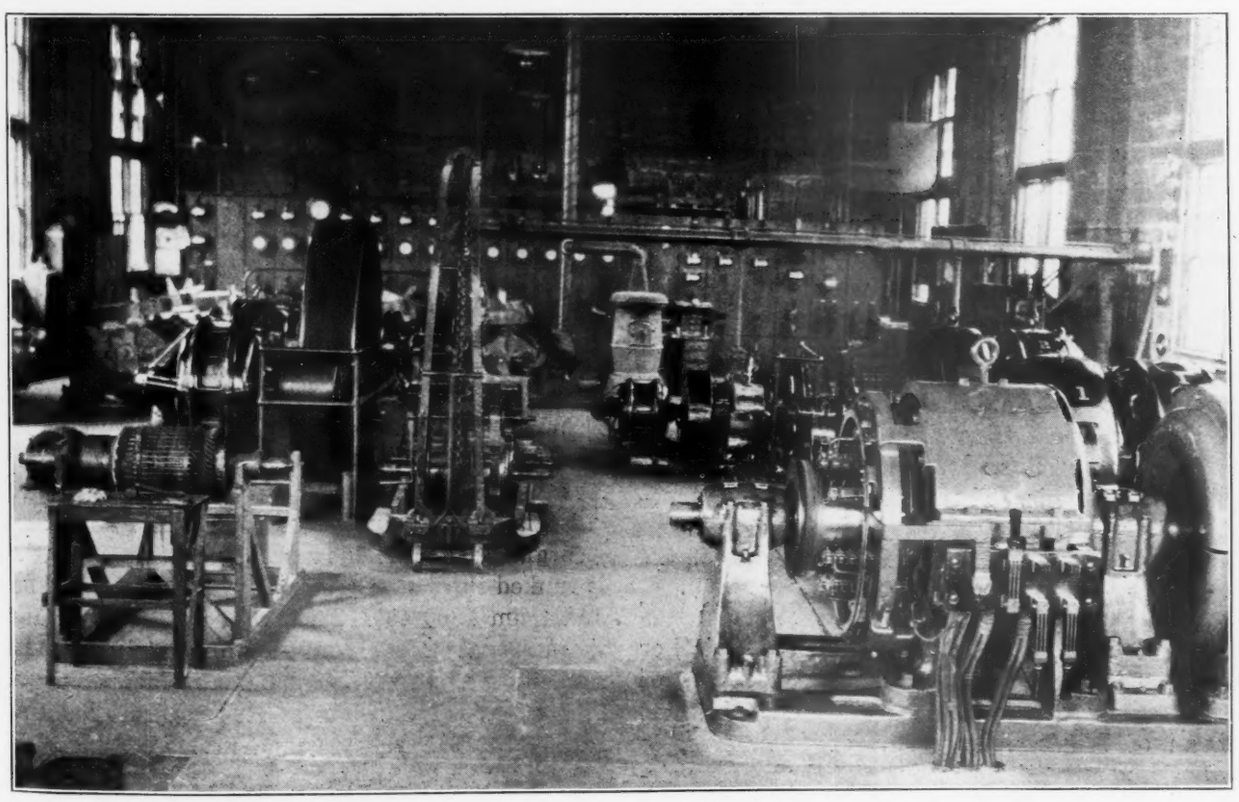
Power comes into the property at 33,000 volts from the lines of the Public Service Company of Northern Illinois and is stepped down to 440 volts by two 750 kilowatt transformers distributing over circuits each having an oil switch and meter.

Two Allis Chalmers induction motor generators of 200 kilowatt capacity furnish the direct current for the Woodford electric haulage system and a Crocker Wheeler synchronous motor generator 580 k.v.a. unit furnishes additional power.

An Ingersoll Rand Type 10, 16 x 10 x 14 air compressor with a 450 foot capacity furnishes air for the machine shop and for the pneumatic drills in the quarry in conjunction with the compressor in the quarry which was previously described. Two 7 x 8 Blaisdell single stage air compressors driven by electric motors through Link Belt silent chain drives are kept in reserve for an emergency. A 3 ton Canton number 4 portable crane handles the motors and parts. Nine Allis Chalmers motors are stored in the power house at present and are to be installed in new cars as they are built.

The machine shop occupies the major part of a large frame building to the west of the main plant which also houses the office and truck scale room. All of the repair work that cannot be done in the car or electrical motor repair shops is done here.

A 10 h.p. General Electric motor runs an overhead shaft which drives by belt a 16 inch Van Wyck Machine Tool Company lathe, a P. and J. Barnes number 4 drill press, a National Machinery Company 1½ inch thread cutter, a Marvel number 2 draw cut saw, a grindstone and an emery wheel and buffer. A 15 h.p. electric motor in another part of the shop also drives an overhead shaft which operates a Niles Tool Works boring machine of 5 inch capacity, a planer, and a 100 ton press which operates by means of an eccentric on the drive shaft. The eccentric motion operates a



Interior of Power House Showing Motor Generators at Right and Air Compressor at Left

cylinder which compresses the air and operates the press. This machine will pull freight car wheels from the axles.

Other pieces of equipment run by individual motors are a South Bend Lathe Works 21 inch swing, 10 foot bed lathe, driven by a 3 h.p. electric motor, a Beaudry drop hammer run by a 10 h.p. electric motor, and a Bridgeport Machine Tool Works 36 inch lathe with a 10 foot bed operated by a 20 h.p. electric motor. A 1 ton Yale hoist handles small parts.

A Westinghouse portable field rheostat Type WL, operates an electric welding torch. At the time the plant was visited a large shovel bucket was being repaired. New manganese plates had been riveted on by pneumatic riveters and the electric welding torch was being used to add metal to parts that had been worn away. Acetylene torches are also used for cutting and welding. A neat and orderly stock room is maintained between the machine shop and office in which all parts that might possibly be needed are stored.

A small repair shop at the south face of the quarry is maintained to keep the cars in working order at all times. All of the car repairing except electrical work is done here as well as the assembling of new cars. A separate control system in the repair shop operates the cars on the side tracks to the main line and in and out of the repair shop. Two overhead Yale spur geared hoists of 8 ton capacity handle the parts being repaired. Other equipment includes several vises, jacks, miscellaneous tools and spare parts and a neatly arranged rack for bolts and small parts. This building also houses two boilers which are used in winter to heat the water for the steam shovels. A large steel tank furnishes water to the boilers.

This plant and its various economies of operation are well known throughout the industry and credit for the high standing of the company is largely due to the efforts and sound business principles of its president, J. F. Talbot, and vice president, O. P. Chamberlain. Mr. Chamberlain has been and still is very active in the affairs of the National Crushed Stone Association and it is largely due to his highly ethical and intelligent management of the affairs of the Dolese and Shepard Company that the crushed stone industry in the Chicago territory is on the sound economic basis that it now is. Thomas Jones is superintendent of the plant.

Use of Megger Circuit in Prospecting

The increasing interest in the use of electrical or other geophysical methods for the location of underground ore deposits has led the United States Bureau of Mines, Department of Commerce, to study the possibilities of the use of the megger circuit for the measurement of the variation of ground resistivity, an important factor in this means of mineral prospecting.

The megger may be used to measure the various average resistivities at different depths from the surface or to compare the various average resistivities at the same depths. With its use it is possible to locate the direction of the dip and strike of a concealed intrusion, such as a body of ore. About three sites or areas can be measured in one day to a depth of 600 ft., by a crew of three men.

Uses of Fuller's Earth

Fuller's earth is used mainly as a filtering medium in clarifying or bleaching fats, greases, and mineral and vegetable oils, according to the United States Bureau of Mines, Department of Commerce. Its original use was in fulling woolen cloth, and from that it derived its name, but such use, at least in this country, has almost been abandoned. Fuller's earth is also said to be used in the manufacture of pigments for printing wall paper, in detecting certain coloring matters in some food products, as a substitute for talcum powder, and in medicine as a poultice and as an antidote for alkaloid poisons.

Fuller's earth was first discovered in the United States in 1891 near Alexander, Ark., by John Olsen. The mineral was used for a time by the Southern Cotton Oil Co., at Little Rock, Ark., but its use was finally abandoned. The real beginning of the industry in this country, however, was in 1893, near Quincy, Fla., when quite by accident, in an unsuccessful effort to burn brick on the property of the Owl Cigar Co., an employee called attention to the close resemblance between the clay used and the German fuller's earth. This discovery in Florida caused considerable excitement, and deposits of fuller's earth were reported from a number of states, but the material in most of these deposits was found to have no value as fuller's earth. Production began in Florida almost immediately after the discovery, and from 1897 to 1899 fuller's earth was produced in Florida, Colorado, New York and Utah. Florida maintained its rank as the leading producer continuously until 1924. In 1901 Arkansas again became a producer. From 1904 to 1907 Arkansas was the second largest producer, but no production of fuller's earth has been reported from Arkansas since 1922. Fuller's earth was found in Georgia soon after the discovery in Florida, but Georgia did not become a producer until 1907, when it ranked third as a producing state; it ranked second from 1909 to 1923, except in 1918 and 1919 when Texas was second; and since 1924 it has ranked first. In 1904 Alabama and Massachusetts, in 1907 South Carolina and Texas, in 1909 California, in 1918 Nevada, and in 1922 Illinois and Pennsylvania first appeared as producers. Pennsylvania has reported no production since 1922.

PIT AND QUARRY FOREIGN DIGEST

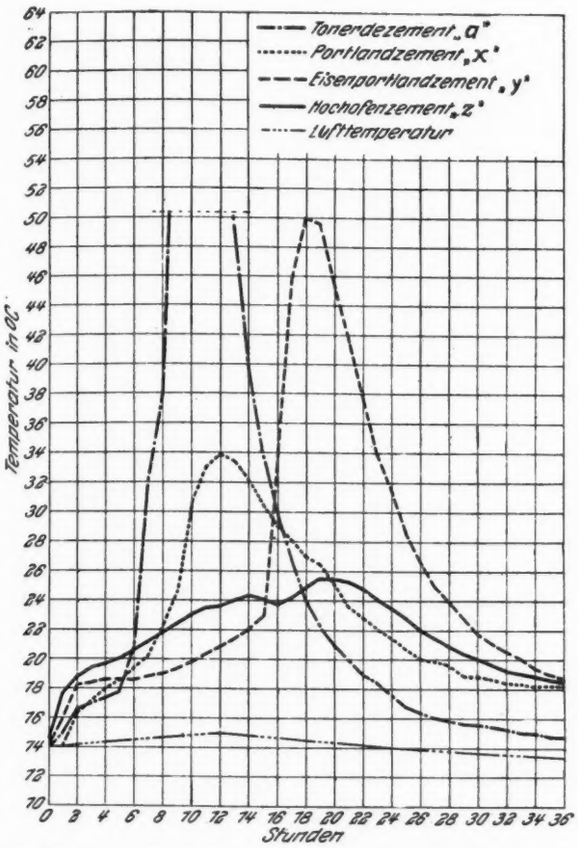


Figure I—"Tonerdezement"=Aluminous Cement; "Portlandzement"=Portland Cement; "Eisenportlandzement"=Iron Portland Cement; "Hochofenzement"=Blast Furnace Cement; "Lufttemperatur"=Temperature of the Air; "Stunden"=Hours

Setting Heat of Cements

The heat evolved in the setting of pure cements was used as a means of comparing this factor in several different varieties. The total amount of heat was not measured but the temperatures obtained at various intervals after the initial set. The apparatus used was not insulated, which resulted in a considerable heat loss, considered by the author to be comparable throughout. This lack of insulation was thought desirable, as otherwise the temperature would mount very high and remain for longer periods. The results of these experiments are shown in Figure I. As the thermometer used was not graduated above 50 degrees C., the maximum for aluminous cement was not recorded. None of the other cements gave temperatures higher than this under the conditions used. Portland cement showed a maximum at 34 degrees C. after 12 hours, iron Portland, 50 degrees C. after 18 hours, blast furnace cement 25 degrees C. after 20 hours. It is worthy of note that the blast furnace cement cooled off comparatively slowly after reaching its maximum, indicating the possibility that this cement remains warm longer than the others. The sharp rise and fall in the case of aluminous cement indicates that all the heat of setting is liberated in a few hours time, over so short an interval that it is released with almost explosive violence.—R. Grün (Zement, September 13, 1928).

A New Cement Shaft Kiln

This kiln makes use of compressed air under high pressure under the sintering zone, which has for its purpose the lessening of the height of the kiln and increasing its capacity. Figure II shows this furnace. The goods are introduced first in the preheating and calcinating zone **a**, then into the sintering zone **b**, later to the cooling zone **c**, and then to the discharge mechanism **f**. A blower **d**, introduces air through, the rings **e**, at various heights in the kiln from the grate to just under the sintering zone. A. Adams (German Patent Application 46, 601).

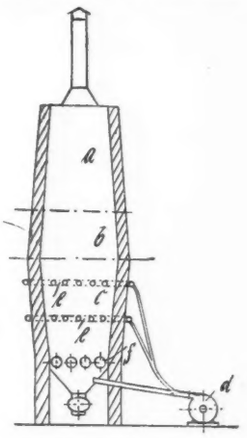


Figure II

Free Lime in Slags and Cements

Glycerin possesses the property of dissolving lime without affecting the other calcium compounds. It forms a glycerate with lime with evolution of heat, and the measurement of the latter constitutes the determination. This method is made possible by the facts that (1) glycerin does not combine with compounds which evolve considerable heat, such as calcium silicate, aluminate or ferrite; (2) it does not dissolve these substances; and (3) it dissolves free lime. The ammonium acetate method of titration depends upon this reaction:

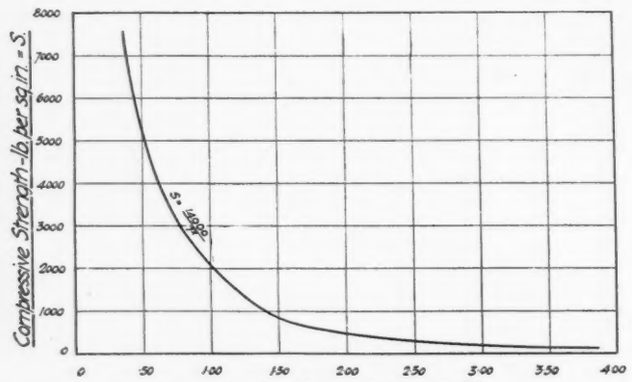
$$CaO + 2\ CH_3\ CO_2NH_4 \longrightarrow Ca(CH_3\ CO_2)_2 + NH_3 + H_2O.$$

The cement is treated with neutral alcohol, phenolphthalein added and titrated with ammonium acetate at the boiling point. The ammonia evolved boils off, and the solution becomes colorless at the end point. In place of measuring the heat evolved during the solution of free lime by glycerin, the compound itself, which is alkaline, may be titrated in alcohol solution with phenolphthalein. Diepschlag & Matting (Zement, September 13, 1928).

Rapid Determination of Iron

This method depends upon the solution of the cement in hydrochloric acid, reduction of the ferric to ferrous iron, and then back titrating with standard $KMnO_4$ solution to the usual red end point. However, the excess of reducing agent must be removed before titration and other precautions taken. The method is carried out as follows: The

HCl solution is reduced with an excess $SnCl_2$, the excess of this salt converted to $SnCl_4$ by means of $HgCl_2$. $MnSO_4$ is added to retard the oxidation of the chloride by permanganate. Phosphoric acid is added to avoid the yellow color of ferric salts, and sulphuric acid to insure solution of the precipitated MnO_2. The titration is then made. M. Elber (Rev. Materiaux Constr. Travaux Publics 1928 pp. 161-162).



Relation between Strength of Concrete and Water Content.
Twenty-eight-day compression tests of 6"by12" cylinders.

Figure III

The Water-Cement Ratio

Abram's formula may be derived as follows: The strength of a concrete mixture depends on the quantity of mixing water in the batch expressed as a ratio to the volume of cement, so long as the concrete is workable and the aggregates are clean and structurally sound. The strength of the concrete decreases as the water ratio increases.

Figure III shows the relation between the compressive strength and the water-cement ratio for 28 days tests of 6 by 12 inch concrete cylinders. Mixes from 15: 1 to neat cement were used; each mix was made up of aggregates ranging in size from 14-mesh sand up to 1½ in. gravel; a wide range in consistencies was used for all mixes and gradings. The equation of the curve is of the form:

$$S = \frac{A}{Bx}$$

where S = compressive strength of concrete at 28 days.
x = water-cement ratio, by volume.
A = a constant.
B = a constant.

For the conditions of the tests shown, the equation was:

$$S = \frac{14{,}000}{7x}$$

The reason a rich mixture gives a higher strength than a lean one is not that more cement is used, but that the concrete can be mixed (and usually is mixed) with a water ratio which is relatively lower for the richer mixtures than for the lean ones. The mere use of richer mixtures has encouraged a feeling of security, whereas in many instances nothing more has been accomplished than wasting a large quantity of cement, due to the use of an excess of mixing water. Without regard to the actual quantity of mixing water, the following rule is a safe one to follow: Use the smallest quantity of mixing water that will produce a plastic or workable concrete.

The importance of any method of mixing, handling, placing and finishing concrete which will enable the builder to reduce the water content of the concrete to a minimum is at once apparent. Coultas considers Abram's formula $S = \frac{A}{Bx}$, and states that A is a factor dependent on the cement and B is a factor dependent on the mixing and rigidity of control. S is strength of the concrete at 28 days in pounds per square inch and x is the water-cement ratio by volume. Minimum values of x are:

0.4 for Portland Cements.
0.7 for Aluminous Cements.

The following values were obtained:

Cement	A	B	Remarks
Portland	14,000	9	Rigid control lacking.
Portland	14,000	7	Average conditions.
Portland	14,000	5.85	Hand mixed batches.
Portland	14,000	4.5	On an actual job.
Aluminous	36,000	9	
R.H.Portland	20,000	9	
R.H.Portland	20,000	4.5	

J. Singleton-Green (The Structural Engineer, London, September, 1928).

Methods of Obtaining Strong Gypsum Cement

By replacing part of the H_2O in a cement mixture with alcohol a stronger cement should result, as the particles separated would be smaller. With gypsum cement ($CaSO_4.0.5H_2O$), EtOH in fact retards the rate of hardening and increases the strength. MeOH has a similar but greater effect. Portland cement did not show this phenomenon. Gypsum cement heated at 120 degrees, 8 hours a day for 1 month gives a stronger cement than when unheated. Heating at the highest temperature of the Bunsen burner, however, lowers the strength, even although the cement so treated has the same amount of H_2O as that heated at 120 degrees. Experiments are being continued. Tutomu Maeda. Sci. Papers Inst. Phys. Chem. Research (Tokyo 8, Supplement No. 3, 8-9, 1928. Chemical Abs.).

INTIMATE NEWS OF MEN AND PLANTS

New Corporations

Atlas Portland Cement Co. of Texas, Waco, Tex. $2,000,000. Nat Harris, Texas attorney, Waco. Parent office, 25 Broadway, New York City.

National Portland Cement Co., Dallas, Tex. 150,000 shares n.p.v. E. S. Gates, C. S. Atkinson, Houston, Tex.; H. J. Harris, Dallas; Richard B. Hill, Fort Worth.

Interstate Cement Corp., Rosendale, N. Y. 5,000 shares n.p.v. Andrew J. Snyder, Pres.

San Leandro Rock Co., 1273 Foothill Blvd., San Leandro, Calif. $100,000. O. F. Chichester, Pres.; H. C. Barton, Sec.

Soft Rock Products Co., Inc., Adams, N. Y. $30,000. Wm. S. and Chas. S. Weldon, Smithville; Shirley Weldon, Adams; Lena Warrener, Lisbon.

Catskill Mountain Quarries, Tannersville, N. Y. $3,000. M. C. Moseman, Correspondent.

Shawnee Stone Co., Bloomington, Ind. $100,000. J. T. Torphy, W. R. Moran, Fred W. Washmund. (Merger of Oolitic Stone Co. and W. R. Mahan Co., previously announced.)

Dixie Rock Asphalt Co., Ypsilanti, Mich. $250,000. S. W. Raymond, Adrian; F. H. Clark, Belleville; F. L. Gallup, Ypsilanti.

Camargo Sand & Gravel Co., Camargo, Okla. $30,000. L. S. Fisher, Woodward; W. R. Rence, Tonkawa; V. R. French, Camargo.

Santa Clara Sand & Gravel Co., 2072 E. Main St., Ventura, Calif. $75,000. S. Lyon, Office Mgr.; J. T. Raleigh; both of Ventura; Mike and Howard Lang, Los Angeles.

Bay Sand & Gravel Corp., L. W. Hall, Oyster Bay, N. Y. 500 shares n.p.v.

Lambertville Trap Rock Co., c/o Edwin G. Adams, Sr., 972 Broad St., Newark, N. J. $3,000. Edwin C. Adams, Jr., Essex Falls, N. J.; Philip D. Elliot, 972 Broad St., Newark.

Mozark Quarries Co., Doe Run, Mo. 600 shares common, $100 each; 400 shares pfd., $100 each. Will quarry granite and other stone. Phil D. Stout, Louis E. Fricke, Vandalia, Mo.; Chas. W. Medley, Knob Lick, Mo. Walter H. Barenfinger, attorney, Vandalia, Mo.

Silver Mica Mining Corp., Burnsville, N. C. $30,000. E. H. Threadgill, 446 N. E. 26th St., Miami, Fla.; Alexander Boddie, 219 N. E. 40th St., Miami; C. R. Hamrick, Burnsville, N. C.

Montana Cement Plant To Begin Operation

The Three Forks Portland Cement Company plant at Manhattan, Montana, began operations about September 15 according to Superintendent Leh. About 170 men have been hired.

New Michigan Marl Pit

The Twin Springs Marl Company recently began operation of a marl pit on the E. H. Sherburn farm north of Buchanan, Michigan, and is producing 100 tons per day. Sidney Smith, former professor of the Emanuel Missionary college, is in charge. The company also operates pits at Berrien Springs and Sodus.

Detroit Graphite Purchases

The Detroit Graphite Company recently purchased for cash 60,000 square feet of property with a 232-foot frontage on Fort Street just east of Twelfth Street, Detroit, and adjoining the present property.

Arizona Company to Make Slag Paving Brick

The Slag Paving Brick and Products Company, an Arizona corporation with a capital of $750,000, has been formed to manufacture slag paving brick and blocks. A $300,000 plant is to be built at Globe, Arizona. The process of manufacturing the brick was discovered by Charles T. Bray, secretary and treasurer of the company of which William T. Nobitt is president.

California Quarry Sold

The San Leandro Rock Company was recently formed by O. F. Chichester, to operate the quarry at Lake Chabot near San Leandro, California, which he purchased from Joseph Costello for the sum of $100,000. Many improvements are being made and the capacity of the plant is being increased. Chris Hopper, former building inspector of San Leandro, is super- Officers and directors are: O. F. Chichester, president; H. C. Barton, secretary; and Elizabeth Chichester.

Illinois Sand and Gravel Meeting Held

The Illinois Sand and Gravel Association, composed of sand and gravel companies marketing products in Illinois, held one of its regular meetings at the Lincoln Country Club, Lincoln, on Wednesday, September 12. Thirty companies were represented at the meeting.

The morning was devoted to the transaction of asssociation business and a get-together for the members present. Luncheon was served in the country club dining room. The annual golf tournament of the Association was played in the afternoon, each member playing 18 holes.

North Carolina Mica Plant Operating

The Catawba Mica Corporation was recently formed at Newton, North Carolina. Mining machinery is in place and mining operations have begun. Officers of the corporation are: M. Zimtbaum, president; J. W. Abernethey, vice president; and J. W. Yount, secretary and treasurer, all of Newton.

Pennsylvania Quarry Sold

The Mann Company, Incorporated, recently purchased a quarry which was formerly operated by Mogee, McNichol, Richardson, and Ross. This quarry is located on the opposite side of the Pennsylvania railroad right-of-way from the present Mann quarry near Norristown, Pennsylvania and includes about six acres of land.

International Transfers Edwin Struckman

Edwin Struckman, for the past several years general superintendent of the Knickerbocker Cement Company plant near Hudson, New York, has been transferred to the Western department of the International Cement Company with headquarters at Kansas City, Kansas. In addition to the Knickerbocker plant Mr. Struckman was general superintendent of the plants at Newcastle, Indiana and Norfolk, Virginia, owned by the same company.

Montana Gravel Plant Begins Operations

The Bradford Sand and Gravel Company recently began operations at the new plant west of Great Falls, Montana. The plant obtains its material from pits about 20 miles west of that city and brings it to the plant for washing and grading. The Great Northern railway recently completed a 2,500 foot spur track to the pits.

Production of Stone in 1927

Production of stone in the United States in 1927, exclusive of stone manufactured into lime, cement, and abrasive materials, or crushed into sand, amounted to 136,345,260 short tons, valued at $198,661,622, according to compilation of reports from producers made by the United States Bureau of Mines, Department of Commerce. The figures show an increase of 10 per cent over the 1926 production figure of 124,496,360 short tons.

Stone sold for curbing, rubble, crushed stone, agricultural limestone, riprap, manufacturing industries, and miscellaneous uses increased in quantity and stone sold for construction, monumental stone, paving blocks, flux, and refractory decreased.

Building Stone

The building stone sold amounted to 32,104,200 cubic feet—4 per cent less than in 1926. This includes stone for architectural work and relatively low-priced stone for rough construction, such as foundation, bridges, and unshaped face stone for buildings and retaining walls.

More than one-half of the building stone sold was limestone—17,340,690 cubic feet, valued at $18,820,045, this quantity being 6 per cent less than in 1926. The largest quarry center for building limestone, the Bedford-Bloomington district in Indiana, reported total sales from the quarries of 13,572,950 cubic feet in 1927, valued at $16,407,170, a decrease of 4 per cent in quantity over 1926. Of this total 5,445,970 cubic feet, valued at $3,461,369 was sold as rough stone; 5,268,060 cubic feet, $4,685,844, sawed stone and semi-finished stone; and 2,858,920 cubic feet, $8,259,957 cut stone. The mills of this district not operated in connection with the quarries reported sales of 728,000 cubic feet of sawed stone, valued at $704,732; 35,030 cubic feet of semi-finished stone, valued at $58,056; and 907,440 cubic feet of cut stone, valued at $2,883,657. High grade building limestone quarried at Carthage, Mo., amounted to 339,260 cubic feet; at Bowling Green, Ky., to 198,770 cubic feet; at Mankato and Kasota, Minn., to 199,640 cubic feet.

Total sales of granite for building stone (6,397,830 cubic feet, valued at $7,672,112), represented nearly one-fifth of the building stone produced in 1927, and decreased 22 per cent in quantity over 1926. The granite sold for architectural work, including rough and dressed stone, was 2,073,550 cubic feet, valued at $6,963,541. The principal States producing granite for architectural building stone were Massachusetts (574,060 cubic feet), Maine (417,740 cubic feet), Minnesota (269,080 cubic feet), New Hampshire (147,060 cubic feet), California (110,950 cubic feet), and Georgia (97,110 cubic feet), Pennsylvania, Massachusetts, and Maryland produced a considerable quantity of granite for rough construction work.

Total sales of sandstone for building (3,995,370 cubic feet, valued at $3,025,864), an increase in quantity of 19 per cent from 1926. Sandstone for architectural work, including rough, sawed, and finished stone, amounted to 2,252,200 cubic feet, valued at $2,809,927. Ohio produced 1,636,710 cubic feet. Kentucky, New York, Pennsylvania, Wisconsin, and other States also reported considerable amounts.

Marble sold for building stone in 1927 amounted to 2,823,790 cubic feet, valued at $10,739,228, 2 per cent less in quantity than in 1926. The principal States producing building marble are Tennessee (965,820 cubic feet), Missouri (526,780 cubic feet), Vermont (807,110 cubic feet), and Georgia (187,060 cubic feet). Alabama, Alaska, Arizona, Arkansas, California, Colorado, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, and Utah also furnish marble for building purposes. The product from Georgia and Missouri is chiefly for exterior building and that from Tennessee and Vermont for interior work. Serpentine (100,000 cubic feet, valued at $641,845) quarried in Maryland, Massachusetts, New Jersey, Pennsylvania, and Vermont, is included in the marble figures. There was also sold 22,930 short tons of serpentine, valued at $94,730. The total sales of marble reported from Carthage, Mo., for 1927, were 350,000 cubic feet, valued at $741,694, a decrease in quantity of 23.8 per cent from 1926. This includes a small quantity of monumental stone.

Basalt showed decreased output for 1927, and various miscellaneous varieties of stone used chiefly for rough construction showed a large increase.

Monumental and Memorial Stone

Stone sold for monumental and memorial work in 1927 amounted to 4,327,270 cubic feet, valued at $14,993,091, a decrease of less than 1 per cent in quantity.

Granite (including rough and dressed stone) reported as sold for this purpose in 1927 was 3,199,790 cubic feet, valued at $10,895,842, a decrease of 1 per cent in quantity. The principal States producing granite for monumental work in 1927 were Vermont (1,286,170 cubic feet, of which the Barre district produced 1,115,400 cubic feet), Massachusetts (359,590 cubic feet, of which the Quincy district produced 256,150 cubic feet), Georgia (236,770 cubic feet), Minnesota (227,620 cubic feet), Wisconsin (125,110 cubic feet), California (103,520 cubic feet), Rhode Island (103,490 cubic feet), New Hampshire (98,670 cubic feet), and Maine (73,800 cubic feet).

Sales of marble for monumental work (including rough and finished stone) in 1927 were reported as 1,127,480 cubic feet, valued at $4,097,249, an increase of 3 per cent in quantity. Vermont produced 675,600 cubic feet, Georgia 366,080 cubic feet, and Alabama, Arkansas, Colorado, Massachusetts, Missouri, New York, North Carolina, and Tennessee much smaller amounts.

Stone Sold or Used by Producers in the United States, 1926 and 1927, by Uses

Use	1926 Quantity	1926 Value	1927 Quantity	1927 Value
Building stone, cubic feet	33,467,420	$39,922,851	32,104,200	$40,595,127
Short tons—approximate	2,609,190	.....	2,485,120	.....
Monumental stone, cubic feet	4,335,770	14,580,929	4,327,270	14,993,091
Short tons—approximate	359,950	.....	358,130	.....
Paving blocks, number	39,563,180	3,399,602	38,705,560	3,583,400
Short tons—approximate	366,370	.....	366,740	.....
Curbing, cubic feet	4,409,930	4,303,280	4,862,580	4,939,716
Short tons—approximate	346,020	.....	378,230	.....
Flagging, cubic feet	902,424	657,435	737,680	573,736
Short tons—approximate	66,330	.....	55,160	.....
Rubble, short tons	539,670	917,433	809,020	998,108
Riprap, short tons	4,060,280	4,652,717	4,618,500	4,716,731
Crushed stone, short tons	82,515,560	87,872,014	94,948,770	97,474,267
Furnace flux (limestone and marble), short tons	23,859,390	18,049,012	21,666,070	15,985,525
Refractory stone (ganister, mica schist, and dolomite), short tons	1,531,070	1,925,832	1,362,920	1,710,708
Agricultural limestone, short tons	1,850,620	3,064,235	2,206,470	3,360,704
Manufacturing industries (limestone and marble), short tons	4,953,800	4,376,026	5,352,130	4,735,114
Other uses, short tons	1,438,110	4,587,224	1,738,000	4,995,395
Total (quantities approximate in short tons)	124,496,360	$188,308,590	136,345,260	$198,661,622

Street and Road Work and Concrete

Street and road material in general showed increased sales in 1927, although sales of paving blocks (38,705,560 blocks, valued at $3,583,400) decreased 2 per cent in quantity. Stone sold for flagstones (737,680 cubic feet, valued at $573,736) decreased 18 per cent. Stone sold for curbing (4,862,580 cubic feet, valued at $4,939,716) increased 10 per cent in quantity. Total crushed stone amounted to 94,948,770 short tons, valued at $97,474,267 in 1927, an increase of 15 per cent in quantity. Crushed stone for concrete and road work (78,544,210 tons, valued at $84,177,237) increased 17 per cent in quantity, and crushed stone reported as used for railroad ballast (16,404,560 tons, valued at $13,297,030) increased 5 per cent.

Fluxing Stone

Stone sold for fluxing to blast furnaces, open hearth steel works, smelters, and other metallurgical plants amounted to 21,666,070 short tons, valued at $15,985,525, a decrease of 9 per cent in quantity.

Refractory Stone

Stone reported for refractory use, which includes dolomite, quartzite, and mica schist, amounted to 1,362,920 short tons, valued at $1,710,708, in 1927, a decrease in quantity of 11 per cent. Raw dolomite reported as sold for the manufacture of refractories in 1927 amounted to 434,160 short tons, valued at $424,140. Besides this quantity, operators who both quarry and dead-burn or sinter dolomite, reported 374,415 tons of sintered material, valued at $3,459,803. The quantity of raw dolomite reported was 15 per cent less than in 1926, and the sintered material decreased 3 per cent. Quartzite (ganister) used in the manufacture of refractory brick, for furnace lining, and for the manufacture of ferrosilicon, amounted to 900,720 short tons, valued at $1,164,768. This was a decrease of 9 per cent in quantity. Sales of mica schist for furnace and kiln lining, which is quarried in Montgomery County, Pa., near Edge Hill, amounted to 28,040 tons, valued at $121,800, a decrease in quantity of 21 per cent.

Sales in 1927 of pulverized limestone for agricultural use amounted to 2,206,470 tons, valued at $3,360,704, an increase of 19 per cent in quantity over the sales for 1926. The accompanying table shows the sales of stone in 1927 by uses and the sales for 1926 for comparison.

Huron Speed Reducers

The Huron Industries, Inc., of Alpena, Michigan, have on the market a heavy duty, mill type speed reducer with the entire reduction mechanism enclosed in a two-piece semi-steel housing. All parts are accessible by removing a few bolts and lifting the housing cover. The joint surfaces are closely machined and fitted and when firmly bolted together are oil tight. A bridge wall which acts as a rigid bearing support for the reduction mechanism and reduces vibration is cast integral with the housing. A vent is provided to take care of expansion of oil and air inside the housing.

No discs, ring gears or planetary gears are used in this reducer and there are no overhanging gears or pinions. Reduction is attained direct through a train of spur gears which are cut from forged or special alloy steel and so supported as to insure perfect alignment. The shafts are of high grade special alloy steel, accurately machined and designed for an ample over-load. All bushings and bearings are manufactured in the Huron plant of high grade phosphor bronze and are designed to give a maximum of wearing service. Each reducer is designed and built to suit the reduction and horsepower at which it is rated, no attempt being made to standardize the housing or other parts by using them for more than one size of reducer.

Lubrication is through an improved positive force-feed and bath system which insures a constant flow of oil to all bearings and wearing surfaces. A specially designed suction pump forces the oil from a reservoir in the bridge wall of the housing to the main bearing where it enters the shafting through radial openings to the axis. It then flows through the shafting to points opposite all bearings where it is emitted through radial openings direct to the wearing surfaces. The bath from the gears also supplies oil to the bearings through special oil holes.

The base plates made of one piece cast semi-steel insure rigidity and eliminate any possibility of vibration or misalignment. Special couplings of improved design, either flexible or rigid, are made for all sizes of reducers, the rigid couplings being of the male and female type to insure perfect alignment and maximum strength. The reducers are made with or without provisions for outboard bearings so that the final drive may be by chain or gear where required.

Deister Vibrating Screen and Classifier Described

The Deister Machine Company, Fort Wayne, Indiana, is distributing illustrated Bulletin number 19 describing the new Deister Plat-o vibrating screen and the cone baffle classifier for use in the mining and quarrying industries.

The vibrating screen is made in two standard sizes, one with 3 by 6 feet and the other 4 by 6 feet, of effective screening area. The single open type is standard but they are also built compeltely enclosed and with double or triple decks. Screens which have been furnished in single deck can be transformed into double deck by an additional screen assembly.

The frame is a 3 sided sheet metal box of 3/16 inch metal, welded together and braced by a double row of five steel tubes, welded at their ends into the sides of the box. Four coil springs supporting the box absorb vibrations.

The vibrating mechanism consists of a heavy main shaft mounted at each end in self-aligning spherical bearings. A pair of unbalanced pulleys with weighted portions cast integral are mounted on each end of the shaft concentric with it, the outer and larger pulley of each pair being rigidly keyed to the shaft.

The screen cloth is held at the discharge end by angle clamps and at the feed end by a tension plate. The cross members are arranged in an arc enabling the cloth to be carried at medium tension and preventing whipping of the cloth which might decrease its life. The screen can be operated either from a line shaft or by an individual motor. The standard motor equipment is a 2 h. p., 3 phase, 60 cycle 220/440 volt, totally enclosed, self-ventilated, roller bearing electric motor, operating at 1,800 r. p. m.

The cone baffle classifier consists of a cast iron barrel in which are placed a number of inverted hollow cast iron cones. These are provided with openings large enough to permit free passage of coarse material and are placed so that these openings are staggered. This construction causes the heavier particles to fall in a zig-zag course while being washed by the current of water which follows a zig-zag course upward.

This classifier has a capacity on 8 mesh material of 50 to 125 tons; on 20 mesh, 40 to 100 tons; and 60 mesh of 20 to 75 tons per 24 hour day, depending on the kind of material. The amount of water used varies from 10 to 22 gallons per minute for each spigot.

NEWS OF EQUIPMENT MANUFACTURERS

Pennsylvania Single Roll Crushers Described

The Pennsylvania Crusher Company, Philadelphia, Pennsylvania, is distributing two new catalogs of equipment manufactured.

Bulletin 2004 describes a new series of single roll crushers for reducing "one and two man" limestones, gypsums, limes, and shales to two inches and down in one operation. They are self feeders and material may be dumped continuously into the crusher hopper without fear of clogging or jamming.

These crushers are made in sizes from 21 by 40 inches to 24 by 60 inches and with the exception of the flywheel and crushing roll are of steel construction. Bearings are heavy and are fitted with removable wear bushings and water jackets. The frame is of one piece steel without bolted joints and hinged breaker plate. All of the wearing parts are easily accessible for inspection or repairs. Operating speeds vary from 40 to 65 r.p.m. Drive is either by pulleys or by enclosed gear direct motor drive.

Bulletin 2003 describes larger crushers of the same type for steam shovel feed. They are made in six sizes of from 30 by 48 inches to 36 by 72 inches and with capacities from 200 to 1,000 tons hourly of wet, dry or frozen materials. Roll speeds vary from 40 to 55 r.p.m. One piece roll shells with integral cast teeth are used and when worn down can be built up again by electric welding. The direct gear drive is enclosed and runs in a dust tight oil bath, and a special safety relief protects the gears against damage from abnormal shocks. Wear can be compensated in all of these crushers by shimming the breaker plate.

New Bucyrus-Erie Shovels Described

The Bucyrus-Erie Company of South Milwaukee, Wisconsin; Erie, Pennsylvania; and Evansville, Indiana, in Bulletin C-504 describes the 50-B steam shovel, dragline, clamshell and crane. This machine has a 2 yard capacity as a shovel and 1½ yards as a dragline, clamshell or crane.

The truck frame is a single annealed steel casting and the engines and machinery are mounted on a rigid steel revolving frame casting. This frame is centered on the base by a center pintle construction so that there are no digging strains on the vertical propelling shaft. The 36 inch tread caterpillar type mounting is very simple, consisting of only one driving tumbler, one take-up tumbler, two rollers and 29 links on each side. The rollers are of large diameter and can be removed without disconnecting the caterpillar chain. The link and tread are in one piece made of an annealed steel casting. The drive is by direct gear.

The boom is all steel box girder construction and the dipper handles are of the outside type. The A-frame is attached to and supported by the steel casting revolving frame. The main engine is 8 by 9 inches; the swing and boom engines 6½ by 6 inches, and the boiler pressure is 125 pounds.

A supplementary Bulletin B-503 describes the 50-B shovel equipped with a 4 cylinder 300 r.p.m. Diesel type engine. General specifications of this machine are very similar to those of the steam shovel.

Taylor Announces Results of Chain Experiments

The S. G. Taylor Chain Company of Hammond, Indiana, announces that for the past several years it has been experimenting with various grades of chain in connection with the kettle type. The results have been most satisfactory to one of the large Gypsum Companies which states it receives approximately seven times the amount of wear from the especially treated steel drag chain. This chain is made and treated by a specially developed formula by the Taylor people after an exhaustive test in actual service.

A New Two Yard Shovel

The Link Belt Company of Chicago, Indianapolis, and Philadelphia has announced the addition of a full 2 yard capacity machine to its line of crawler cranes, shovels and draglines. Heretofore, the largest machine built by the company was a 1½ yard unit. The K-55, as the new machine is known, is a powerful all purpose machine, designed for the following adaptations: Shovel with a 30 foot boom and 18 foot dipper stick carrying a 2 yard capacity manganese steel dipper; dragline to handle a 2 yard bucket on a 50 foot boom or a 1½ yard bucket for a 60 foot boom; clamshell of 2 yard capacity on a 50 foot boom; and a 1½ yard shell on a 60 foot boom; and a 2 yard capacity trench hoe. All attachments are interchangeable without removing or disturbing the mechanism of the machine. A special clearance reducing arrangement makes it possible to ship it from place to place without dismantling. It has a collapsible mast, and special shipping treads which may be substituted for the working treads to bring it within the railroad clearance requirements.

It has cast steel upper and lower frames, self cleaning crawler treads, bronze bushed crawler rollers, enclosed cut gearings and bronze bushed bearings throughout. The large drums have renewable cast steel shells and air spaces between the clutch and brake surfaces. The machine is 12 feet wide over all and crawler treads are 36 inches wide. The K-55 is built to be driven with a gasoline or Diesel engine, or an electric motor.

Portable Hoppers Described

The Northern Conveyor Manufacturing Company, Milwaukee, Wisconsin, is distributing a pamphlet describing the Northern portable conveyor, portable steel hoppers, and measuring devices. These hoppers are 10 feet by 10 feet and are made in capacities of from 10 to 30 cubic yards and heights of 16 to 23 feet.

The Northern adjustable measuring device for sand, gravel, and stone will measure accurately any quantity from ½ to 1 cubic yard or 10 to 28 cubic feet. A graduated scale and pointer makes adjusting a simple matter and an indicator shows when the hopper is full.

New Falk Flexible Couplings

The Falk Corporation, Milwaukee, Wisconsin, recently published a new Bulletin number 180 on flexible couplings. This bulletin contains information not included in the issue it supersedes and lists one additional size of coupling, the 20½ C.

The Type CS coupling which was developed for close coupled applications and the CH type for high speed turbine work are described. Both of these types operate on the same principles as the standard series and are particularly adapted for absorbing shocks and compensating for misalignment of coupled shafts. A new list of service factors is included which in most cases has been reduced to allow the selection of smaller and less expensive couplings.

A Portable Paving Unit

The Los Angeles Paving Company of Los Angeles, California, is engaged in wide spread operations in asphaltic and cement concrete road building. It is using a unit designed and built by the Madsden Iron Works of Huntington Park, California. This unit permits of proportioning sand and rock according to any specification, either by weight or volume.

The specially designed proportioning box contains two easily variable compartments, one for sand and one for rock. The size of either compartment may be changed by pulling out the collapsible sides to pin holes spaced at one-half cubic foot and hand locking screws fix the position. A semi-automatic drop gate empties both compartments into a truck below, the weight of the material locking the gate open until the operator trips the control. The storage bin is a standard 85 ton capacity portable type constructed entirely of steel with collapsible sides and with double acting jacks on the "H" section columns. The entire unit may be lowered on to a motor truck and moved to any desired location, the knocking down and setting up only requiring a few hours.

New Oxweld Cutting Machine

An automatic oxy-acetylene machine, designed to cut shapes of any sort from steel plate, sheet, forgings, billets or ingots is being introduced by the Linde Air Products Company, 30 E. 42nd Street, New York. In this machine the cutting blowpipe is mounted on a carriage which is moved in any direction by means of an electric motor. In cases where only a few parts are to be cut out, a hand tracing device can be attached and used to follow the outline of a sketch. The parts of the machine are sturdily built and of rigid construction. The speed of cutting ranges from 3 to 20 inches per minute, depending on the thickness of the metal.

Biehl Creeper Dump Wagons Described

The Biehl Iron Works, Inc., of Reading, Pennsylvania, recently published an illustrated catalog describing the Biehl creeper dump wagon. This wagon is made in four sizes of 3, 5, 8 and 10 yard water level capacity and is designed to be hauled behind a crawler tractor.

The front axle is of chrome nickel steel protected by a heavy electric steel casting and is connected with the front end of the wagon by an oversize king pin. The 8 and 10 yard capacity wagons have double disc steel front wheels with heavy electric steel hub castings and are fitted with Timken tapered roller bearings with dust collars and cap. Greasing of these wheels is necessary only once a month.

The bodies are of steel plate construction, the 3, 5 and 8 yard sizes being made of 3/16 inch body sheets and ¼ inch door sheets, and the 10 yard size of ¼ inch body sheets and 5/16 inch door sheets. The creeper wheels which carry 87 per cent of the load are of 4, 6, 10 and 15 ton capacities respectively, and have no intermediate rollers, guides or sprockets. Total weights of these wagons vary from 7,760 pounds up to 17,000 pounds, over all heights from 4 feet 7¾ inches to 6 feet 5 inches and over all lengths from 16 feet 1 inch to 24 feet 8 inches for the various sizes.

A special wagon for oil and lumber use is also described. The design is essentially the same as in the dump wagon except that it is made in 4, 6, and 10 ton capacities.

Distributors Announced By Trackson Company

The following tractor and equipment companies have recently been appointed distributors in western territories for the Trackson Company. For McCormick-Deering Tractors: B. Hayman Company, Inc., 118-128 No. Los Angeles St., Los Angeles, California; O. R. Peterson Company, Inc., corner 21st and Alabama Sts., San Francisco; Polson Implement Company, Seattle, Washington; and Zimmerman-Wells-Brown Company, foot of Sheridan St., Portland, Oregon. These companies are handling repair and replacement parts for the machines.

Ideal Electric Discusses Air Compressors

The Ideal Electric and Manufacturing Company, Mansfield, Ohio, is distributing Circular No. 501 giving flywheel effect recommendations for air compressors based on Ideal synchronous motor drive. This bulletin contains illustrations of Ideal installations and graphic curves, and gives information on how to obtain flywheel effect for any type, horsepower or speed. These curves, which give the relation between current pulsation and the flywheel effect, are based on a standard motor of 100 h.p. 200 r.p.m. and 60 cycles. An example at the bottom of each shows how to use the curve for each type of compressor.

A Successful Water Lubricant

The Rathbun Company of El Paso, Texas, is distributing a 4-page illustrated folder that describes Scalena. This folder states that "all water needs lubrication" and points out that Scalena is used for that purpose for engines, automobiles, compressors and other industrial machines.

Traylor Engineering Appoints Sales Engineer

The Traylor Engineering and Manufacturing Company of Allentown, Pensylvania, announces the appointment of Foster E. Benner to the position of sales engineer in the Chicago office. Mr. Benner, who has been connected with the main office at Allentown for a number of years, is thoroughly conversant with the policies of the Company and familiar with its products. Bernard Haislip is district manager at 1414 Fisher Building, Chicago.

Falk Appoints B. W. Rogers

The Falk Corporation of Milwaukee, Wisconsin, has appointed B. W. Rogers, 225 Central Savings and Trust Building, Akron, Ohio, as their representative in Akron and vicinity for Falk herringbone gears, speed reducers and flexible couplings. Mr. Rogers was previously connected with the B. F. Goodrich Company and before that had been with the Allis-Chalmers Manufacturing Company.

Linde Opens New Plant

A new plant of the Linde Air Products Company, located at 125 Settlement Street, Akron, Ohio, started producing oxygen on September 11. This plant, of which A. Deagen is superintendent, will supply the nearby demand for oxygen used in welding and cutting by the oxy-acetylene process.

Portable Air Compressors Described

The P. K. Lindsay Company, Boston, Massachusetts, is distributing a pamphlet describing several types of small high speed portable air compressors for operating small pneumatic tools, and blasting lettering on stone, and spray painting.

The Model M. 4 is electrically driven by a 1 h. p. motor, weighs 115 pounds, and has a capacity of 8 c. f. m. at 1725 r. p. m. The Model E 6 weighs 180 pounds, is driven by 1½ h. p. gasoline engine, and has a capacity of 12 c. f. m. at 1400 r. p. m. The Model E 3 weighs 165 pounds, is driven by a ⅞ h. p. gasoline engine, and has a capacity of 7 c. f. m. at 1400 r. p. m.

Rates for display advertisements in the Broadcast Section are given below. If you want to buy or sell used equipment, if you want a job or need a man, advertise your wants in Pit and Quarry. Advertisement copy for publication in the next issue should reach our office within one week after the date of this issue.

RATES PER INSERTION	1 Inch	2 Inches	3 Inches	4 Inches	5 Inches	6 Inches	8 Inches	9 Inches	10 Inches	12 Inches	15 Inches	20 Inches	30 Inches
1 Insertion	$ 3.75	$ 7.25	$10.75	$14.25	$17.75	$ 21.25	$28.25	$31.75	$35.25	$42.25	$56.25	$70.25	$105.00
2 Insertions	3.75	7.25	10.70	14.20	17.65	21.15	28.15	31.65	35.15	42.15	56.15	70.00	104.00
3 Insertions	3.75	7.20	10.65	14.15	17.55	21.05	28.05	31.55	35.10	42.05	56.05	69.75	103.00
4 Insertions	3.70	7.15	10.60	14.10	17.45	20.95	27.95	31.45	35.00	41.95	55.90	68.75	101.00
8 Insertions	3.65	7.05	10.50	14.00	17.25	20.75	27.75	31.25	34.80	41.75	55.70	67.50	98.00
13 Insertions	3.60	6.95	10.40	13.90	17.05	20.55	27.55	31.05	34.60	41.55	55.55	66.25	94.00
26 Insertions	3.50	6.75	10.20	13.70	16.65	20.05	27.05	30.65	34.20	41.05	55.05	64.00	88.00

INFORMATION—"Broadcast" space is sold by the advertising "inch." Each page contains 30 inches. The width of the page is divided into 3 columns, each 2¼ inches wide. Each column contains 10 inches measured the length of the column. Any space may be used measured by the *even* inch in height (not fractions), by 1, 2 or 3 columns in width. The size of a space is its height in inches multiplied by the number of columns in width. Example: a space 3 inches high by 2 columns wide is 6 inches. Copy changes made without additional charge.

It Pays to Advertise in PIT and QUARRY

"More than pleased. Thanks"—writes J. W. Vorhis, Elliston, Mont., regarding the results received from his advertisement.

Complete Service Publishing Company

538 South Clark Street CHICAGO

Machinery for Sale

SPECIALS
1—4½'x16" Hardinge Steel Lined Mill
1—No. 6 Williams Universal Hammer Mill

CRUSHERS

Crushing Rolls

1—8"x5", 2—14"x20", 4—24"x12", 1—26"x15", 1—30"x10", 1—30"x16", 2—36"x16", 2—42"x16", 1—54"x24".

Gyratory

All sizes from No. 2 Reduction to No. 12K.

Jaw

One 4"x8"—two 7"x10"—one 6"x20"—two 9"x15"—one 10"x20"—two 12"x24"—one 18"x36"—one 24"x36"—one 42"x30".

Rotary

Two No. 0, two No. 1, one No. 1½, and one No. 2 Sturtevant Rotary Fine Crushers.

Ring Roll

One No. 1 and one No. 2 Duplex Sturtevant ring roll mills.

Ball and Tube Mills

3', 4', 4½', 5', 5½', 6', 8' Hardinge Mills and Tube Mills.

DRYERS

One 3'x30', Three 4'x30', One 4½'x30', One 5'x40', One 5½'x40', One 6'x60', One 7'x60' and One 8'x80' Direct Heat Rotary Dryers, One 5'x25', One 6'x30', Two 8'x80' Ruggles Coles type "A" and One 4'x20' Ruggles Coles type "B" Double Shell Rotary Dryers.

KILNS

4'x40', 5'x60', 6'x60', 6'x70', 6'x90', 6'x100', 6'x120', 7'x80', 8'x125'.

MILLS

Two 33" and two 42" Fuller Lehigh Mills.
1 No. 0000, 1 No. 00, 2 No. 1, 2—4 Roll, and 1—5 Roll Raymond.
Swing Hammer Mills, Griffin Mills, Attrition and Cage Mills.
Air separators, Screens, Elevators and Conveyors.

The Heineken Engineering Corp.
Industrial Engineers
117 Liberty St., New York City
Courtlandt 5130

CRAWLER SHOVELS

1—LORAIN 75, GASOLINE: New 1926, 1¼ yd.; HIGH LIFT.

1—OSGOOD HEAVY DUTY, GASOLINE: New 1927; 1-yd., High Lift. Also 40 ft. Crane Boom, if desired.

1—ERIE B-2 DREADNAUGHT: Steam, New 1927, 1-yd., High Lift.

1—MARION MODEL 37, Steam, New 1926, 1¾ yd. Dipper, Boom 26 ft. Dipper Handle 17 ft., Overhauled.

CRANES

4—UNIVERSAL TRUCKCRANES, New 1927, 5-ton Mack Trucks, Wauesha Motors, 24 ft. Booms, Bucket Operating, Like New (2 with Crawlers).

1—12-ton cap. NORTHWEST, No. 105, GASOLINE, Crawler Crane, New 1927, 40 ft. Boom, Bucket Operating, Like New.

Grey Steel Products Company
111 Broadway New York, N. Y.

CRUSHERS
Farrel 15-B-24 x 36 Jaw.
Kennedy No. 42 Gyratory Breaker.
Austin No. 10 Gyratory.
Gates 7½-K, Fine shape.
Kennedy Gearless No. 37 Reduction.
Gates Gyratory 12-K, 9-K, 7½-K 4N and 3.
McCully Gyratory No. 8 5, 4 and 3.
Symons Disc, 48, 36, 24 and 18-in.
Allis Chalmers Blake Jaw Crusher 12x24 and 18x24.
Good Roads 10x20 portable and 10 x 20 on Skids.
Raymond Mill No. 1.
Stephens-Adamson all Steel Bucket, Elevator Style No. 22—60' Centers.
Stephens-Adamson Pan Conveyor.
Jaw Crushers 7x15, 9x18, 9x15 & 10x20.
Crushing Rolls 16x42, 54x24 & 14x20.
Blake Type Jaw Crusher 18 x 24.
Sturtevant No. 1½ Rotary Fine Crusher.
OTHER CRUSHERS, SCREENS & CONVEYORS

CRANES & SHOVELS
Marion 37 Steam Shovel Cat. 1¾ yd. A-1.
Marion 21, Gas. Electric, 1 yd., like new.
Bucyrus Cl. 14 Cat. Dragline 80' boom, 2 yd.
Bucyrus Cl. 24 Dragline electric 100' Boom.
Byers Bearcat Pull Shovel, ½ yd.
Northwest 104 & 105 Shovels.
P. & H. 206 Dragline, 38' Boom.
Speeder ½ yd. Gas. Cat. Shovel.
Byers Bearcat Crane 28' Boom, low price.
O. & S. Gas Cat. 40' Boom.
Byers Truck Crane 30' Boom, ¾ yd.
Thew Cat. Shovel ¾ yd.; low price.
Other makes and sizes on hand.

COMPRESSORS, CARS, LOCOMOTIVES, BOILERS AND POWER EQUIPMENT

F. MAYER
53 W. Jackson Blvd. Chicago, Ill.

BUCKETS

2-yd. Hayward Heavy Duty, 3 Leaf Orange Peel.
¾-yd. Hayward Heavy Duty 3 Leaf Orange Peel.
1—4 cu. ft. and 1—5 cu. ft. Hayward Std. 4 Leaf Orange Peel Buckets.
1—1-yd. Hayward Clam Shell.
1—¾-yd. Williams Clam Shell.
1—½-yd. Mead-Morrison Clam Shell.
All Buckets in Chicago Warehouse Stock and Guaranteed Strictly First Class Condition.

Miscellaneous

5-½-yd. and 1—1-yd. Sauerman Drag-Scraper and Slackline Outfits, complete.
2—15 H. P. Dbl Drum Clyde Hoists, gasoline.
3—30 H. P., C. H. & E. Dbl. Drum Hoists, gasoline.
30—Elect. Hoists, Sgl. and Dbl. Drum, 5 H. P. to 112 H. P. in both A. C. and D. C. Current.
2—Ligerwood Dbl. Drum Belted Hoists good for 8,000 lbs. sgl. line or 75 H. P. Max.
48-in. Symons Disc Crusher, latest type.
18-in. Bucket Elevator, complete.
200 H. P. Diesel Oil Engine, complete.
6-in. and 8-in. Manganese Sand Pumps, Belted.
13x18-in. Slide Valve Steam Engine.
All sizes electric Generators, Motors, Steam Boilers, Engines, Pumps, Crushers, Screens, Air Compressors, etc.

Lakeside Machinery Company
117 North Dearborn Street
Chicago, Illinois
Warehouses and Yards
4501 W. Cortland St. 2335 W. Austin Ave.

GASOLINE SHOVELS AND CRANES
1—1¼ Yd. Lorain 75 Cat. Shovel.
1—Link Belt Combination Cat. 1 Yd. Shovel and 50' crane boom.
1—Model 105 Northwest Combination ¾ yd. shovel and 40' crane boom.
1—Byers Bearcat Cat. with 30' crane boom.

GAS LOCOMOTIVES
1—12 ton Whitcomb standard gauge.
1— 7 ton Plymouth 36" gauge.

HOSTING ENGINES
1—60 HP National 3 drum 3 phase, 60 cycle 220 volts with swinger.
1—22 HP Lambert DD 3 phase, 60 cycle, 220 volts.
1—8¼x10 Stroudsburg Triple Drum Hoist with swinger. Boiler mounted.

DERRICKS
3—5 to 7 ton all-steel stiffleg derricks.
1—10 ton Wooden Stiffleg Derrick 80' boom.

BOILERS
1—100 HP Locomotive Type, ASME.
1—125 HP Locomotive Type, ASME.

DUMP CARS
6—4 yd. Western 36" gauge, steel beam and steel floors. Like new.

B. M. WEISS
1324 Widener Bldg. Philadelphia, Pa.